Micropaq® Monitor

Service Manual

Model 402 and Model 404
Software version 1.5X

WelchAllyn®

Advancing Frontline Care™

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1 Safety Summary

All users of the monitor must read this safety summary and all warning and caution statements in the manual.

General Safety Considerations

- If the monitor detects a problem that prevents it from operating properly, it displays an error message and error number. Report such errors to Welch Allyn.
- Do not service a monitor under warranty. Servicing a monitor under warranty voids the warranty. All service on monitors under warranty must be performed by Welch Allyn.Contact Welch Allyn for information about post-warranty period service.
- Frequently check all cables, both electrically and visually.

Definitions

WARNING The Warning symbol indicates a condition that could lead to illness, injury or death.

Caution The Caution symbol indicates a condition that could damage equipment or other property.

Warnings and Cautions

Familiarize yourself with all warnings and cautions before using the monitor.

WARNING The monitor may not meet its performance specifications if stored or used outside the specified temperature and humidity ranges.

WARNING Make frequent electrical and visual checks on cables, sensors, and electrode wires. All cables, sensors, and electrode wires must be inspected and properly maintained and in proper working order to allow the equipment to function properly and protect patient safety.

WARNING If the monitor has been dropped or severely abused, remove it from service until it has passed the functional verification.

Caution Do not autoclave the monitor. Autoclave accessories only if the manufacturer's instructions clearly approve it. Many accessories can be severely damaged by autoclaving.

Symbols

The following symbols appear on the monitor, battery charger or accessories.

Symbol	Definition	Symbol	Definition
⎓	Direct current (battery charger)	IPX1	Enclosure Protection Drip proof: Classification IPX1 per EN60529: 1991
~	Alternating current (battery charger)		Fuse (battery charger)
CE 0123	The CE Mark and Notified Body Registration Number signify the device has met all essential requirements of European Medical Device Directive 93/42/EEC	C SA US	This device has been tested and certified by the Canadian Standards Association International to comply with applicable U.S. and Canadian medical safety standards.
CE	Signifies the device has met all essential requirements of European Medical Device Directive 93/42/EEC for a Class 1 product (battery charger)		Patient connections are Type CF, isolated for direct cardiac application, and protected against defibrillation
⚠	Caution: Refer to Directions For Use and accompanying documentation		For indoor use only (battery charger)
	Non-ionizing electromagnetic radiation		Alarm(s) Off
	Connected to the Acuity network		Not connected to the Acuity network
	Low battery		Do not dispose of this product as 'unsorted municipal waste'. Prepare it for reuse or separate collection as specified by Directive 2002/96/EC of the European Parliament and the Council of the European Union on Waste Electronic and Electrical Equipment (WEEE). (See www.welchallyn.com/weee.) If the monitor, the cradle or the battery is contaminated, this directive does not apply.

Monitor Front Panel Keys			
	Select Key and Silence Patient Alarm/Equipment Alert Key- Selects the choice highlighted on the menu. During patient alarms, silences the tone at the monitor and Acuity (if connected) for 90 seconds. During equipment alerts, silences or acknowledges (dismisses) the alert.		Scroll Up Key and Reset Alarm Tone Key- Scrolls up menus on the display. During patient alarms, resets the tone at the monitor and Acuity (if connected).
	Nurse Call Key - When connected to Acuity, pressing this key sends Acuity a Nurse Call message.		Scroll Down Key and Main Menu Key- Scrolls down menus on the display, or causes the Main Menu to appear if no menu is displayed.

Battery Charger Label and LEDs		
Green LED on continuously		Battery is fully charged.
Green LED flashing		Battery is charging.
Green LED flashing very slowly		Battery detected and waiting to be charged.
Yellow LED on continuously		Something is wrong with the battery or the charger.

Electrostatic Discharge (ESD)

CAUTION
SENSITIVE ELECTRONIC DEVICES
DO NOT SHIP OR STORE NEAR STRONG ELECTROSTATIC, ELECTROMAGNETIC, MAGNETIC OR RADIOACTIVE FIELDS

WARNING Electrostatic discharge (ESD) can damage or destroy electronic components. Handle static-sensitive components only at static-safe workstation.

WARNING Assume that all electrical and electronic components of the monitor are static-sensitive.

Electrostatic discharge is a sudden current flowing from a charged object to another object or to ground. Electrostatic charges can accumulate on common items such as foam drinking cups, cellophane tape, synthetic clothing, untreated foam packaging material, and untreated plastic bags and work folders, to name only a few.

Electronic components and assemblies, if not properly protected against ESD, can be permanently damaged or destroyed when near or in contact with electrostatically charged objects. When you handle components or assemblies that are not in protective bags and you are not sure whether they are static-sensitive, assume that they are static-sensitive and handle them accordingly.

- Perform all service procedures in a static-protected environment. Always use techniques and equipment designed to protect personnel and equipment from electrostatic discharge.
- Remove static-sensitive components and assemblies from their static-shielding bags only at static-safe workstations—a properly grounded table and grounded floor mat—and only when you are wearing a grounded wrist strap (with a resistor of at least 1 megohm in series) or other grounding device.
- Use only grounded tools when inserting, adjusting, or removing static-sensitive components and assemblies.
- Remove or insert static-sensitive components and assemblies only with monitor power turned off.
- Insert and seal static-sensitive components and assemblies into their original static-shielding bags before removing them from static-protected areas.
- Always test your ground strap, bench mat, conductive work surface, and ground cord before removing components and assemblies from their protective bags and before beginning any disassembly or assembly procedures.

2 Overview

Purpose and Scope

This document provides instructions for disassembly and assembly, troubleshooting, functional testing and performance verification for the Micropaq monitor.

This document covers the following monitors:

- Micropaq Model 404 monitor, Masimo version
- Micropaq Model 404 monitor, Nellcor version
- Micropaq Model 402 monitor

For service information about any other monitor, refer to the service manual for that monitor.

Any service work not described in this manual must be performed by qualified service personnel at the factory or at an authorized Welch Allyn service center. (For contact information, see page ii.)

This manual is intended for use only by technically qualified service personnel.

Corrective service is supported to the level of field-replaceable units. Field-replaceable units include certain subassemblies, service kits, and other parts. All field-replaceable parts are listed in "Field Replaceable Units" on page 63.

The following activities are not supported:

- Repair and replacement of the main board, radio board, and SpO_2 board,
- Component-level repair of circuit boards and subassemblies,
- Performance of any service procedure or instruction in any manner other than exactly described in this manual.

WARNING Failure to observe and adhere to these restrictions could lead to serious personal injury.

Caution Failure to observe and adhere to these restrictions could damage the monitor and will invalidate the monitor warranty.

Related Documents

When using this manual, it may be helpful to refer to the following documents:

- *Micropaq Directions for Use*, 810-1177-XX
- Welch Allyn *Products and Accessories*, 810-0409-XX

Technical Support and Repair Services

Service Activity	Monitor	Battery Charger
Parts Replacement	Replace the display, front case (with connectors and keyboard), rear case. Contact Welch Allyn Technical Support for service and monitor exchange policy.	Replace only fuses (see procedure in this manual). Contact Welch Allyn Technical Support for service and monitor exchange policy
Calibration	None required	None required
Periodic Service[a]	Every 6 months to 2 years (per hospital protocols): • Complete functional verification as described in this manual • Inspect the monitor for mechanical and functional damage • Inspect safety labels for legibility	Every 6 months to 2 years: • Complete functional verification as described in this manual • Inspect the battery charger for mechanical and functional damage • Inspect safety labels for legibility • Inspect the rear panel fuses for compliance to specified rating

a. More frequent service may be needed in extreme environments (heat, cold, dust, etc.).

Contact Welch Allyn Technical Support at one of the numbers listed on page ii.

Returning Products

To return a product for service, contact Welch Allyn Technical Support (page ii) and request a Return Material Authorization (RMA) number.

Note Welch Allyn does not accept returned products without an RMA.

When requesting an RMA, please have the following information available:

- Product name, model number, and serial number.
- A complete return shipping address.
- A contact name and phone number.
- Any special shipping instructions.
- A purchase-order number or credit-card number if the product is not covered by warranty.
- A full description of the problem or service request.

Note To ensure safe receipt of your monitor by the service center and to expedite processing and return of the monitor to you, **thoroughly clean all residues from the monitor before you ship it to Welch Allyn**.

United States federal regulations prohibit the processing of any device contaminated with blood-borne pathogens. Welch Allyn thoroughly cleans all returned monitors on receipt, but any monitor that cannot be adequately cleaned cannot be repaired.

Before shipping the monitor, please observe these packing guidelines:

- Remove from the package all hoses, connectors, cables, sensors, power cords, and other ancillary products and equipment, except those items that might be associated with the problem.

- Put the monitor, enclosed in a plastic bag **with a packing list**, into the original shipping carton with the original packing materials or into another appropriate shipping carton.
- Write the Welch Allyn RMA number with the Welch Allyn address on the outside of the shipping carton.

Product Configurations

Configurations for the available model numbers are as follows:

Model	Monitoring Parameters	FlexNet/Acuity Communication Enabled
404	ECG, SpO_2	Yes
402	ECG	Yes

Service Options

Warranty Service

All repairs on products under warranty must be performed or approved by Welch Allyn. Refer all warranty service to Welch Allyn Factory Service or another authorized Welch Allyn Service Center. Obtain an RMA number for all returns to Welch Allyn Factory Service. (See "Returning Products" on page 6.)

Caution Unauthorized repairs will void the product warranty.

Non-Warranty Service

Welch Allyn Beaverton factory service and authorized service centers support non-warranty repairs. Contact any Welch Allyn regional service center for pricing and service options.

Welch Allyn offers modular repair parts for sale to support non-warranty service. This service must be performed only by qualified end-user biomedical/clinical engineers using this service manual.

Micropaq monitor service training is available from Welch Allyn for biomedical/clinical engineers. Contact Welch Allyn Technical Support Services for information.

Connectors, Indicators and Controls

Indicators

Visual Alarm Indicator

Green	Flashes slowly during normal operation.
Red	Flashes during patient alarm. Remains on continuously when alarms are silenced or suspended.
Yellow	Flashes during an equipment alert and while the monitor is not connected to the network. Remains on continuously if the operator suspends an alert at Acuity for 90 seconds or acknowledges (dismisses) a low battery alert from the monitor or Acuity.

Note Flashing green indicates that the monitor is connected to the network but not necessarily connected to a patient. If the monitor is actively monitoring a patient, continuous green indicates that no alarms or alerts are detected.

Audible Alarm Indicator

Beeps to indicate a patient alarm, and beeps faster for life-threatening arrhythmia alarms.

Beeps when the equipment needs attention. This beep tone is slower than the patient alarm tones.

Volume can be configured at Acuity as high, low, or off.

Volume can be configured at Acuity for network connection or for when communications with the FlexNet network are interrupted.

Controls

Nurse Call

- Sends a Nurse Call message to Acuity when the monitor is connected to Acuity. Depending on how Acuity is configured, the Nurse Call message may cause the Acuity Central Station to generate a Nurse Call Alert and/or print a snapshot of the patient waveform at the Acuity Central Station.

Scroll Up and Reset Patient Alarm Tone

- Scrolls up menus on the display.
- Resets a silenced patient alarm tone.

Scroll Down and Main Menu

- Scrolls down menus on the display.
- Displays the Main Menu.

Select and Silence Patient Alarm/Equipment Alert

- Selects the choice highlighted on the menu.

- During patient alarms, silences the tone at the monitor and Acuity (if connected) for 90 seconds. During equipment alerts, silences or acknowledges (dismisses) the alert at the monitor and at Acuity.

Battery

Insert the battery to turn on power. Remove the battery to turn off power. (While the battery is removed, no monitoring occurs.)

Recharge the battery while it is removed from the monitor.

To order a new battery, contact Customer Service (see page ii).

Service Menu

Refer to "Functional Verification" on page 11 for service menus and test screens.

Maintenance

For monitor maintenance information, refer to "Operator Maintenance" in *Micropaq Directions for Use*. Covered topics include the following:

- Inspecting and cleaning the monitor and accessories
- Charging or replacing the battery

3 Functional Verification

This procedure helps to confirm the proper operation of the Micropaq monitor. No monitor disassembly is required.

The following equipment is required:

Model	Required Equipment
402 and 404	• DNI Nevada Inc. Patient Simulator 217A or 214B (or equivalent ECG patient simulator) • Micropaq ECG Cable (008-0522-XX) • Fully charged battery • Access to a properly functioning FlexNet network with an access point within range
404 with Masimo	• Micropaq Masimo SpO2 cable (008-0961-XX) • Masimo adult SpO2 sensor for finger • BIO-TEK Index 2 Series SpO2 Simulator with optical finger for sensor connection (or equivalent)
404 with Nellcor	• Micropaq Nellcor SpO2 cable (008-0754-XX) • Nellcor adult SpO2 sensor for finger • BIO-TEK Index 2 Series SpO2 Simulator with optical finger for sensor connection (or equivalent)

Visual Check

Perform this check if the monitor is being serviced in the field by a biomedical/clinical engineer.

1. Verify that the rubber gasket is not protruding from the case.
2. Verify that the rubber feet have been installed.
3. Verify that screw covers are in place over all four screws in the battery compartment and the small recessed connector next to the battery connector.
4. Verify that the correct labels have been applied to the case. (See "Attaching Labels" on page 48 for Model 404 monitors or "Attaching Labels" on page 60 for Model 402 monitors.)
   a. Verify that the correct rear case label and battery label are attached.
   b. Verify that the serial number label is attached and that the correct information has been recorded for the model number, part number and serial number.
   c. Verify that the clear label cover has been applied over the serial number label.

Power-Up Test

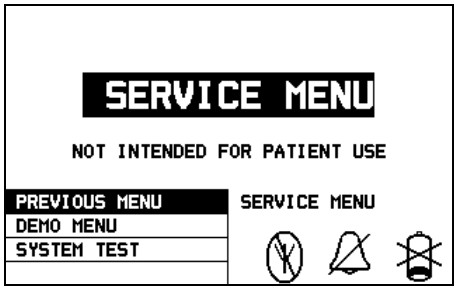
1. Disconnect any patient cables connected to the monitor and remove the battery (if installed).
2. Insert a fully charged battery into the monitor.

   During power-up, the monitor performs a comprehensive self test of software. If software testing is successful, the monitor then tests internal hardware. If all tests are successful, the monitor completes power-up and displays the initial monitoring screen.
3. Confirm the following:
   - The screen is initially blank for a few seconds, that the LED displays each of the three colors (red, yellow and then green), and that the monitor emits two short beeps while booting—a quiet beep followed by a second, louder beep.
   - A power-up screen with the model number appears for a few seconds, followed by an initial monitoring screen with no error messages.

If the monitor does not power up properly, contact Welch Allyn Technical Support (page ii) for assistance.

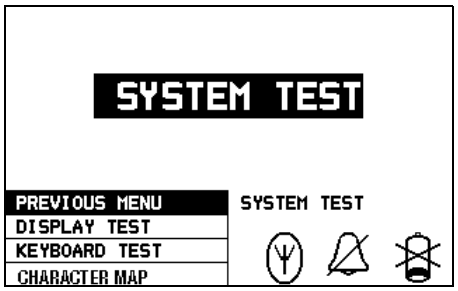
System Test

1. Press ▼ to access the Main Menu, and then repeatedly press ▼ until **SERVICE MENU** is highlighted.
2. Press ✓ to display the Service Menu screen.



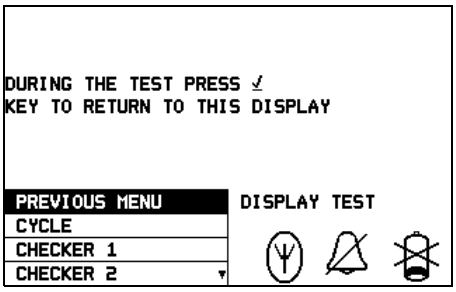
Service Menu Screen

3. Press ▼ to highlight **SYSTEM TEST**, and then press ✓ to display the System Test screen.



System Test Screen

4. Press ▼ to highlight **DISPLAY TEST**, and then press ✓ to display the Display Test screen.



Display Test Screen

5. Press ▼ once to highlight **CYCLE**, and then press ✓.

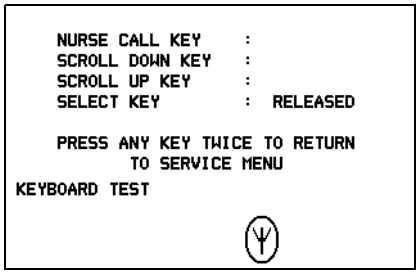
   Press ▼ to cycle through all display tests while observing the screen. Watch for any defects such as pixel deficiencies, stuck pixels, or nonuniform illumination.

   Optionally, you can run any of the other display tests (CHECKER 1 through CHECKER 4, and BORDER). Press ✓ to exit the display test, and then scroll to another test and press ✓ again to run the highlighted display test.

6. Press ✓ to exit the display test and return to the Display Test screen.

7. Press ✓ again to exit the Display Test screen and return to the System Test screen.

8. Press ▼ as needed to highlight **KEYBOARD TEST**, and then press ✓ to display the Keyboard Test screen.



Keyboard Test Screen

9. Observe the screen. For each of the front panel monitor keys (, ▲, ▼, and ✓), press and then release the key.

   Confirm that the screen displays PRESSED and then RELEASED for each key.

10. Exit the Keyboard Test screen by quickly pressing one of the keys twice.

11. Repeatedly press ✓ as needed to exit the service screens and return to the normal monitoring screen.

ECG Test

1. Turn on power to the ECG simulator.
2. Connect the ECG cable to the monitor and to the ECG simulator.
3. Set the ECG simulator for a normal sinus rhythm.

   Confirm that the monitor displays a normal sinus rhythm ECG waveform with a heart rate that is the same (± 4 bpm) as the input of the ECG simulator.
4. Conduct an ECG Lead Fail test:

   a. Remove the far left (LA) lead from the simulator. A skeletal torso appears in the monitor display, with five dots arrayed on it.

   b. In the monitor display, verify that the dot corresponding to the LA electrode is blinking. Reconnect the LA lead to the simulator.

   c. Remove each simulator lead in turn. The corresponding dot blinks with each removed simulator lead, and stops blinking when the switch is released.
5. Disconnect the ECG cable from the simulator and monitor, and then turn off power to the simulator.

Model 402: Testing is complete. Remove the monitor battery.

Model 404: Go on to the next section to test SpO_2.

SpO_2 Test (Model 404 Only)

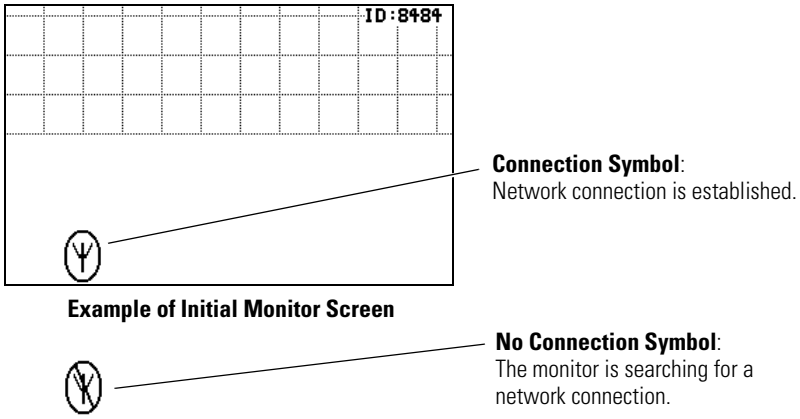
1. Turn on power to the SpO_2 simulator.
2. Connect the SpO_2 cable to the monitor and the SpO_2 sensor.
3. Apply the SpO_2 sensor to the SpO_2 simulator optical finger.
4. Set the SpO_2 simulator manufacturer type ("MAKE") as appropriate: Masimo or Nellcor.
5. Set the simulator output to SpO_2 saturation 94 percent and pulse rate 60 beats per minute (with no motion artifact selected).

   Confirm the following:

   - The monitor displays SpO_2 data and the pulse amplitude indicator is moving.
   - The displayed saturation = 94 percent ± 4 counts.
   - The displayed pulse rate = 60 ± 4 bpm.
6. Disconnect the sensor from the simulator and the cable, disconnect the SpO_2 cable, and remove the monitor battery.

Network Test

Observe the screen and confirm that the network connection symbol appears (indicating that the monitor is communicating with the network).



If the network connection is not yet established, wait a short time (60 seconds or less) and confirm that the connection symbol appears.

Wireless to Acuity Central Communication

Caution Before beginning the following procedure, advise Acuity monitoring personnel that you will be testing the monitor.

To confirm proper communication between the monitor and the Acuity system:

In an area of RF coverage, perform the following test on each monitor.

1. Insert a newly charged battery into the battery compartment of the monitor. A power-up screen appears and is soon replaced by a blank monitoring screen.
2. If the network is configured to allow multiple Acuity systems to view the monitor, select the system from the unit list that will be the primary link in the test.

   If this is a single system, or if the monitor is configured to communicate only with a specific Acuity system, select a patient from the patient list.
3. On Acuity, verify that the Monitor Connecting icon (a blue hourglass) appears in the Wireless area on the Acuity Central Monitor Map (in the Map View). Wait for the Monitor Connecting icon to change to an Unconfirmed Patient ID icon.
4. Verify that the proper last four digits of the monitor serial number appear as the Room Number in the Waveform window and ID screen.

5. Verify that the LED above the screen in the upper right corner of the monitor is blinking green. This indicates communication between the monitor and the Acuity system. Refer to the communication status symbols below, as they appear in the lower left corner of the monitor display.

Monitor with access point association and Acuity communication.

(Flashing) Monitor with access point association, but no Acuity communication.

Monitor with no access point association.

Battery Charger Functional Verification

This procedure helps to confirm the proper operation of the monitor battery charger.

- No battery charger disassembly is required.
- A monitor battery is required.

To verify charger function:

1. Remove any batteries installed in the charger battery wells.
2. Unplug the ac power cord from the rear of the charger.
3. Plug the ac power cord into the rear of the charger and observe the charger top panel.

   Confirm the following:

   - Each green LED blinks in sequence, and then each yellow LED blinks in sequence. This confirms proper operation of the LEDs and the charger software.
   - The green LED by the ac power symbol (at the far right side of the charger's top panel) is on, and that no other LED is on.
4. Insert the battery into a battery well and confirm that the corresponding green LED begins to flash. (The green LED flashes while charging, and remains on continuously when the battery is fully charged.) Remove the battery.
5. Repeat Step 4 for each of the other seven battery wells.

Replace Fuses in the Battery Charger

If the battery charger ac power cord is connected but the green ac power LED is not on, the battery charger fuses may need replacement.

To replace the fuses:

1. Disconnect the ac power cord from the rear panel of the battery charger. The fuse module is located directly beneath the ac power receptacle.
2. Use a small flat-blade screwdriver to pry open the black fuse module.
3. Slide out the fuse module, and then unlatch and slide out the fuse holder.
4. Use the screwdriver to dislodge the two fuses.

5. Insert two fuses of the appropriate rating into the fuse holder:

   Fuses: T1.25 A/250 V, Time-Delay, 5x20 mm (503-0111-XX)

WARNING Fire Hazard. To protect against fire hazard, always replace fuses with the specified type, size, current rating, and voltage rating.

6. Slide the fuse holder back into the black fuse module until it latches securely, and then slide the fuse module back into the charger. Press it firmly and verify that it latches securely.
7. Connect the ac power cord to the rear panel of the battery charger and to an ac power source appropriate for the power rating of the battery charger.
8. Confirm that the green ac power LED is on.

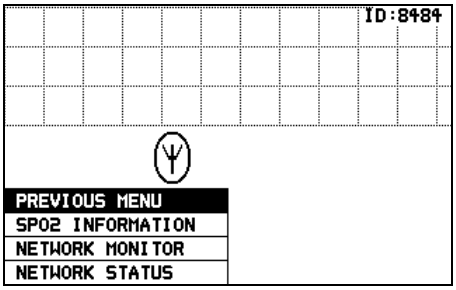
Note If the fuses blow soon after reconnecting ac power, the battery charger may need replacement.

System Information Menu

The System Information Menu provides additional information that may be required during service activity.

To access the System Information Menu:

1. From the monitoring screen, press ▼ to access the Main Menu.
2. Press ▼ again to highlight **SYSTEM INFORMATION**, and then press ✓ to display the System Information Menu.

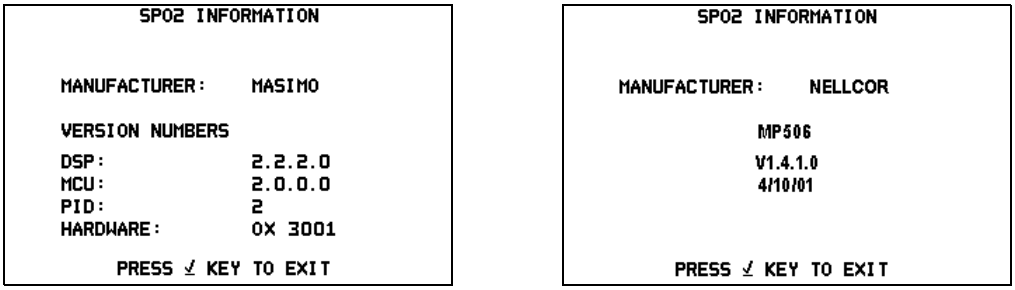


System Information Menu

3. To access one of the menu items, press ▼ or ▲ to highlight the menu item, and press ✓.

Note Although the System Information Menu functions are not intended to be used while the monitor is connected to a patient, they can be used to troubleshoot network activity while the monitor is communicating (or attempting to communicate) with the network.

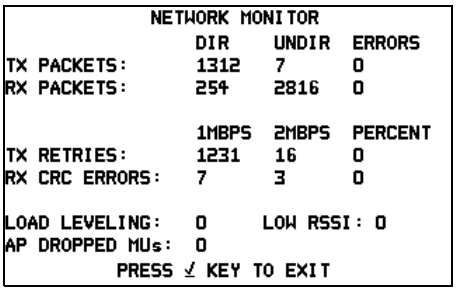
SpO_2 Information



SpO_2 Information Screen Examples

Network Monitor

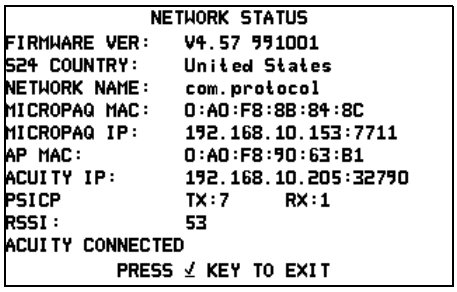
Use the Network Monitor screen as a diagnostic aid for troubleshooting wireless connections between the monitor and a network access point.

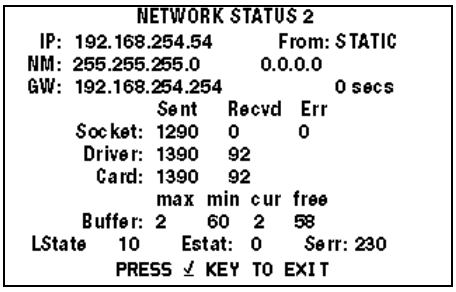

NETWORK MONITOR
DIR UNDIR ERRORS
TX PACKETS: 1312 7 0
RX PACKETS: 254 2816 0
1MBPS 2MBPS PERCENT
TX RETRIES: 1231 16 0
RX CRC ERRORS: 7 3 0
LOAD LEVELING: 0 LOW RSSI: 0
AP DROPPED MUs: 0
PRESS ✓ KEY TO EXIT

LOAD LEVELING	If nonzero, indicates the number of times the monitor has roamed to another access point because the previous access point was too busy. Any nonzero value might indicate a problem with the WLAN or the access points.
AP DROPPED MUs	If nonzero, indicates the number of times the monitor was forced off of the access point it was associated with. Any nonzero value might indicate a problem with the WLAN or the access points.
LOW RSSI	If nonzero, indicates the number of times the monitor has roamed to another access point because the Received Signal Strength Indicator was too low. Any nonzero value might indicate either inadequate WLAN coverage or that monitor was on the edge of coverage for an extended period and was having difficulty passing data to the associated access point.

Network Status

The Network Status screen displays the current status of the monitor and its communication channel.





Network Status Screen Examples

FIRMWARE VER	Firmware version of the radio card.
S24 COUNTRY	Controlled by the access point with which the monitor is associated.
RSSI	(Received Signal Strength Indicator) indicates the strength (in dB) of the radio signal as seen by the associated access point. The smaller the number, the stronger the signal. A value greater than 70 indicates either: • a fault in the monitor or in the radio card, or • an area of poor or no radio coverage
ACUITY CONNECTED	During startup, this briefly displays other messages. After startup, any other message here indicates a communication problem.

Change the Network Name

Use this procedure to change the network name assigned to the monitor.

Note This procedure applies only if the current net name is one of the names available in the Network Name Menu. For other network names, see "Changing a Custom Network Name" on page 22.

Caution Changing the monitor network name will cause the monitor to restart and seek to connect with the FlexNet network corresponding to the new name. Do not attempt to change the network name unless you are a qualified biomedical service engineer or technician.

Changing a Factory-Defined Network Name

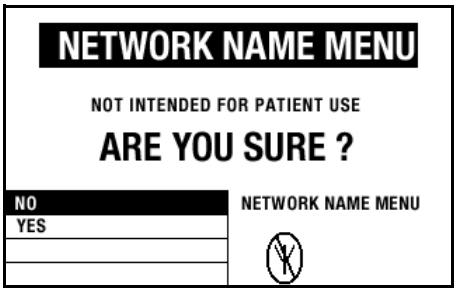
To change the network name:

1. Press ▼ to access the Main Menu, and then repeatedly press ▼ until **SERVICE MENU** is highlighted.
2. Press ✓ to display the Service Menu screen.
3. Press and hold ▼, ▲, and ✓. The Network Name Menu appears.

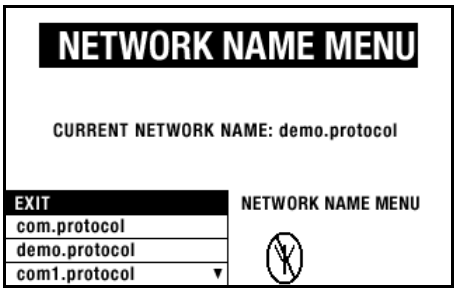
   If the current monitor network name is one of the following factory-defined names:

com.protocol	demo.protocol
com1.protocol	com2.protocol
com3.protocol	com4.protocol
com5.protocol	com6.protocol
com7.protocol	com8.protocol

   then the monitor displays the following screen



4. Verify that **YES** is highlighted, and press ✓ to display the following screen:

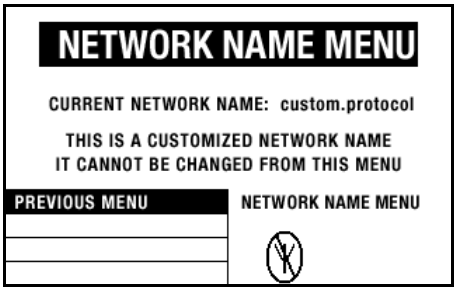


5. Press ▲ or ▼ to highlight the desired network name, and then press ✓.

   The monitor turns itself off, and then turns on and seeks to connect to a FlexNet network with the new network name.

Changing a Custom Network Name

If the current monitor network name is a custom name, the monitor displays the following screen:


NETWORK NAME MENU
CURRENT NETWORK NAME: custom.protocol
THIS IS A CUSTOMIZED NETWORK NAME
IT CANNOT BE CHANGED FROM THIS MENU
PREVIOUS MENU
NETWORK NAME MENU

You cannot change the network name using the Network Name Menu. Press ✓ to return to the Service Menu. Contact Welch Allyn Technical Support (page ii) for assistance.

4 Troubleshooting

Troubleshooting Chart

This troubleshooting chart includes system faults and equipment alerts related to possible internal failures. If other error codes appear, refer to the directions for use for information on the cause and suggested remedy for those errors.

Caution Replace parts, components, or accessories only with parts supplied or approved by Welch Allyn. The use of any other parts can lead to inferior monitor performance and will void the product warranty.

Symptom	Possible Cause	Possible Corrective Action
Keyboard buttons stuck or locked up.	Monitor menu lock function is engaged.	Refer to *Micropaq Monitor Directions for Use*.
	Bad keyboard connection to the main board at connector J3.	Check the keyboard flex cable connection at J3: unlock the ZIF connector, reseat the flex cable, and then relock the connector.
	Keyboard flex cable is shorting out to the metalized subframe (older versions of the monitor only) near connector J3.	Add Kapton tape between the flex cable and the metalized subframe close to connector J3.
	Keyboard flex cable is damaged. Check for sharp bends in the keyboard flex cable.	Replace the front case assembly.
	Defective keyboard.	Replace the front case assembly.
Display intermittent.	Battery not secured against the monitor.	Reinsert the battery. If this does not correct the problem, check the back case for damage to the plastic or to the battery connector.
	Bad display connection to the main board at connector J4.	Check the display flex cable connection at J4: unlock the ZIF connector, reseat the flex cable, and then relock the connector.
	Display flex cable is damaged. Check for sharp bends in the display flex cable. Check for damage at the connection between the flex cable and the display.	Replace the display assembly.
	Defective or damaged display.	Replace the display assembly.
Lines in the display.	Check for display circuit damage caused by improper display installation. Solder connections on the ECG or SpO_2 connectors may damage the display circuit.	Replace the display assembly.

Symptom	Possible Cause	Possible Corrective Action
SpO_2 is not working.	Bad connection to the SpO_2 board. Possible error code OXB87 on the display.	Check connections at the SpO_2 board assembly.
	Bad SpO_2 flex cable connection to the main board at connector J8.	Check the SpO_2 flex cable connection at J8: unlock the ZIF connector, reseat the flex cable, and then relock the connector.
	SpO_2 sensor has no LED.	Check the ground connection to the main board at connector J11.
	Broken SpO_2 flex cable solder connection.	Check for fractured solder joints on the SpO_2 connector (often caused by dropping the monitor). Repair the solder joints and retest the monitor.
	Broken SpO_2 flex cable.	Replace the front case assembly.
	SpO_2 external connector is damaged.	Replace the front case assembly.
	Bad SpO_2 assembly.	Send to Welch Allyn factory service for repair.
ECG "LEADS OFF" message when ECG leads are connected.	Broken ECG flex cable solder connection.	Check for fractured solder joints on the ECG connector (often caused by dropping the monitor). Repair solder joints and retest the monitor.
ECG is not working.	Bad ECG connection.	Check the ECG connection to the main board at connector J1: unlock the ZIF connector, reseat the flex cable, and then relock the connector.
	Broken ECG flex cable solder connection.	Check for fractured solder joints on the ECG connector (often caused by dropping the monitor). Repair solder joints and retest the monitor.
	Broken ECG flex cable.	Replace the appropriate front case assembly.
	ECG external connector is damaged.	Replace the appropriate front case assembly.
	Bad main board.	Send the monitor to Welch Allyn factory service for repair.
The monitor is not making a connection to Acuity.	Outside of access point coverage area.	Move into range of the access point.
	Bad antenna connection.	Send the monitor to Welch Allyn factory service for repair.
	Bad radio card.	Send the monitor to Welch Allyn factory service for repair.
No power or power intermittent.	Broken battery connector.	Send the monitor to Welch Allyn factory service for repair.
The monitor causes rf/emi interference.	Nylon washers and metal washers are incorrectly installed on the SpO_2 board/ shield.	Install nylon washers in the correct locations according to the instructions in "Installing the SpO2 Shield (all models)" on page 45.
	SpO_2 shield is not correctly installed.	Check that the SpO_2 shield is installed according to the instructions in "Installing the SpO2 Shield (all models)" on page 45.
	The flap on the antenna is not covering the ECG connector.	Check that the flap on the antenna is installed according to the instructions in "Installing the Main Board, Subframe and Radio Card" on page 39 or "Installing the Main Board, Subframe and Radio Card" on page 55.

Alert Messages and Display Information

Message and Display Information	**Possible Cause(s) and Suggested Response**
LOW BATTERY	The monitor will shut down in less than 30 minutes due to a low battery. • Replace the battery as soon as possible.
VERY LOW BATTERY	The monitor will shut down in less than 5 minutes due to a low battery. • Replace the battery as soon as possible.
BATTERY TOO LOW SHUT DOWN IN PROGRESS	The battery is so low the monitor has to shut down operation. • Replace the battery immediately.
ACUITY CONNECTION LOST	The monitor is not connected to the network. • Press ✓ to acknowledge and silence the tone and cancel the message. While disconnected from the network, the off-network icon and the yellow LED continue to flash. NOTE: The monitor will continue to attempt to reconnect until it is successful.
EXCESSIVE ECG OFFSET REPLACE ELECTRODES[a]	The monitor detects poor ECG electrode contact. • Check and replace ECG electrodes as needed.
Chest icon is displayed with flashing ECG electrode(s).[a]	The monitor detects that at least one ECG electrodes is disconnected. • Check and replace or reconnect electrodes as needed.
NO ECG CABLE DETECTED	• If the ECG cable has been intentionally disconnected from the monitor, press ✓ to cancel the alert tone. • If the ECG cable has been unintentionally disconnected, reconnect it. Check the patient and monitor to verify that ECG monitoring resumes properly.
NO SpO2 SENSOR DETECTED	The SpO_2 sensor has been disconnected for more than 5 seconds. • If disconnection is intentional, press ✓ to acknowledge and silence the tone. • If disconnection is not intentional, reconnect the sensor or replace the sensor and reconnect.
DEFECTIVE SpO_2 SENSOR[a] *or* UNRECOGNIZED SpO_2 SENSOR[a]	The SpO_2 sensor is either defective or not recognized. • Replace the SpO_2 sensor with a new, compatible SpO_2 sensor.
<*key name*> KEY STUCK[a]	During the power-up self test, the monitor detected that a key is stuck (▼, ▲, ⊖, or ✓). This can happen if you accidentally press a key down before the Main Menu is displayed during power-up. • Remove and then reinsert the battery to power up again and see if the key is still stuck. If it is, contact your biomedical engineering department.
System Error Thread: <*nnn*> Error ID: <*nnn*>	The equipment problem is so serious the monitor cannot be used. • Contact your biomedical engineering department.

a. This alert message can be acknowledged from Acuity, but not from the monitor.

5 Repair Procedures

Introduction

This section provides instructions for disassembly and reassembly of the monitor.

Caution Perform all repair procedures at a static-protected station.

Caution When the monitor case is opened, all parts must be regarded as extremely fragile. All procedure steps must be executed with care and precision.

Required Tools and Equipment

- 3 in. lb. torque driver
- 5 in. lb. torque driver
- #1 Phillips screwdriver bit
- Tweezers
- Needlenose pliers
- Kapton tape
- Soft lens wipes
- Scissors or other cutting device
- Canned air
- Ultrafine-point permanent marker
- Small paper clip

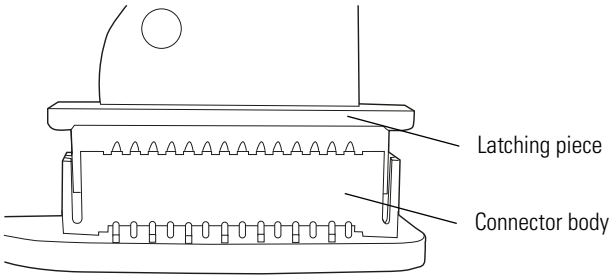
Zero Insertion Force (ZIF) Connectors

The monitor uses flex cables and zero insertion force (ZIF) flex cable connectors. The flex cables are all marked with a designator number which corresponds to a PCB board designator. Flex cables and ZIF connectors require special care when handling them.

ZIF connectors use a sliding outer piece that latches and unlatches to secure and release the flex cable. ZIF cables cannot be successfully connected or disconnected without properly unlatching and latching the sliding outer piece.

Disconnecting a ZIF Cable

1. Using a suitable tool (for example, a paper clip, small flat-head screwdriver, or needle-nose pliers), slide the latching piece of the connector away from the connector body.

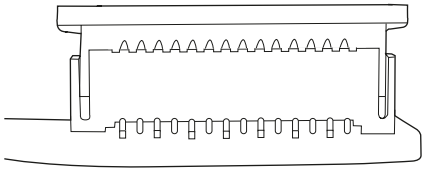


2. Remove the cable.

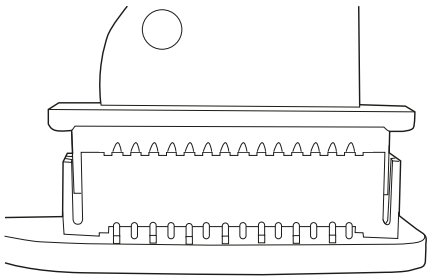
Caution Do not attempt to remove a flex cable until the ZIF latch has been opened.

Connecting a ZIF Cable

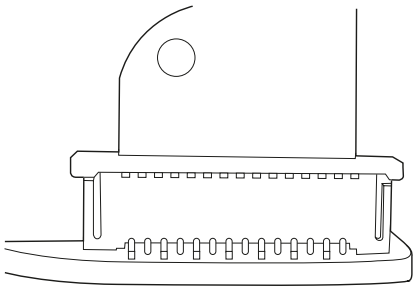
1. Slide the latching piece of the connector away from the connector body.



2. Insert the flex cable into the connector. This may require using a suitable tool to keep the latching piece elevated.



3. Push the latching piece toward the connector body until it locks into place.



Connector Locations

Connector (Main Board)	Description	Connects with	Referred to on...
J1 (ZIF connector)	ECG (flex cable)	External ECG connector (flex cable)	page 34
J3 (ZIF connector)	Keyboard (flex cable)	Keyboard (flex cable)	page 35
J4 (ZIF connector)	Display (flex) cable	Display (flex cable)	page 35
J11	SpO_2 (flex cable)	Main board ground (flex cable)	page 34

Procedures

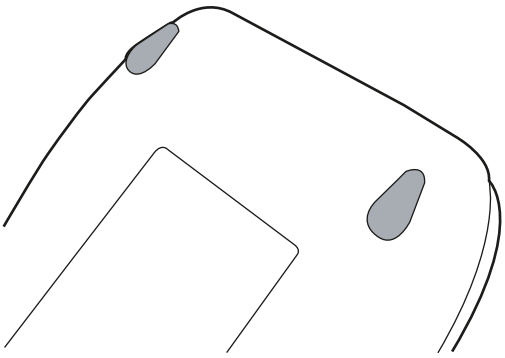
Disassembly - Model 404 30
Reassembly - Model 404 37
Disassembly - Model 402 49
Reassembly - Model 402 53

Disassembly - Model 404

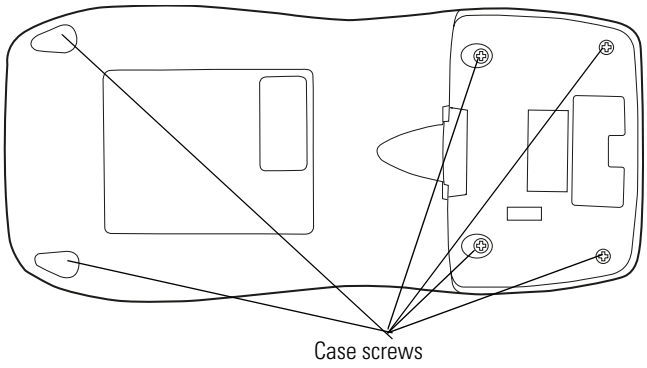
This procedure covers the Masimo and Nellcor versions of the Model 404 monitor with SpO_2.

Opening the Case

1. Remove the battery pack.
2. Remove the rubber feet from the rear panel.



3. Remove the six case screws.

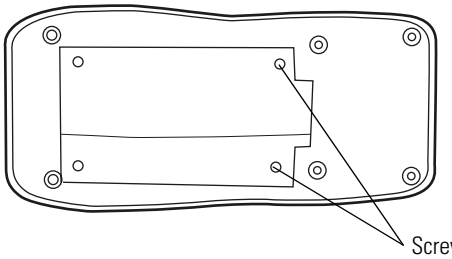


4. Separate the case.

Note If you are replacing only the rear case, proceed to the gasket replacement step on "Closing the Case" on page 46.

Removing the SpO_2 Board

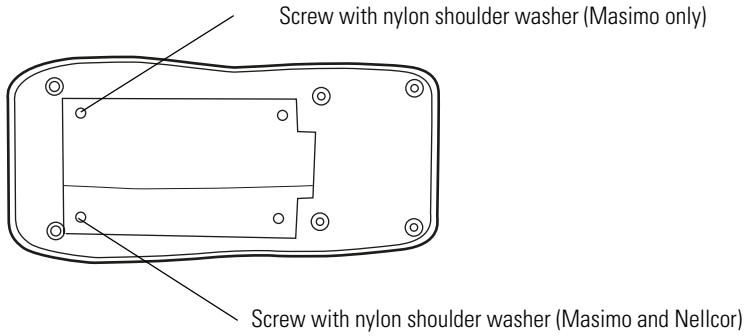
1. Remove the screws and metal washers at the locations shown below.



2. Remove the screws and nylon shoulder washers at the locations shown below.

Note Do not damage the SpO_2 foil shield when removing the nylon shoulder washers.

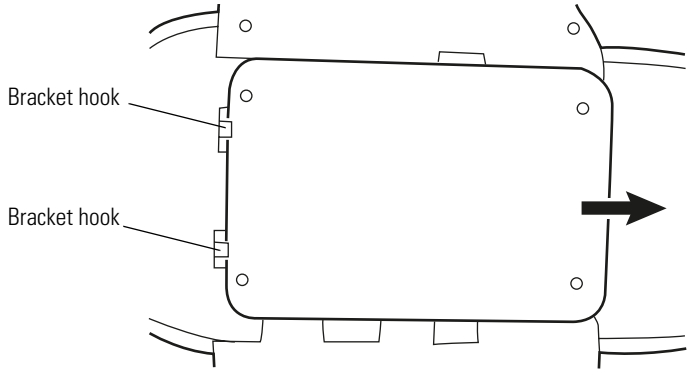
Note The Masimo version has two screws with nylon shoulder washers. The Nellcor version has only one screw with a nylon shoulder washer, as shown below.



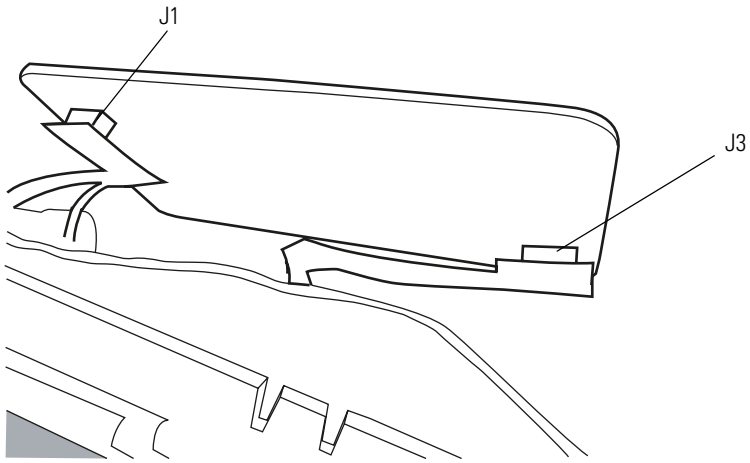
3. Unfold the SpO_2 shield.
4. For Masimo models, continue with the next section. For Nellcor models, continue with "Disconnecting the SpO2 Board (Nellcor models)" on page 33.

Disconnecting the SpO_2 Board (Masimo models)

1. Slide the SpO_2 board out from under the two bracket hooks.



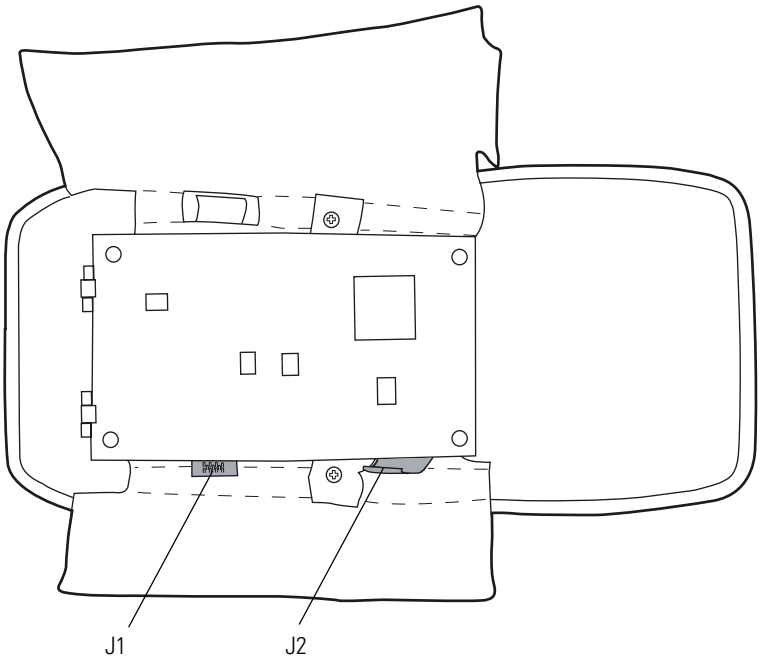
2. Lift the SpO_2 board, and disconnect the flex cables from connectors J1 and J3.



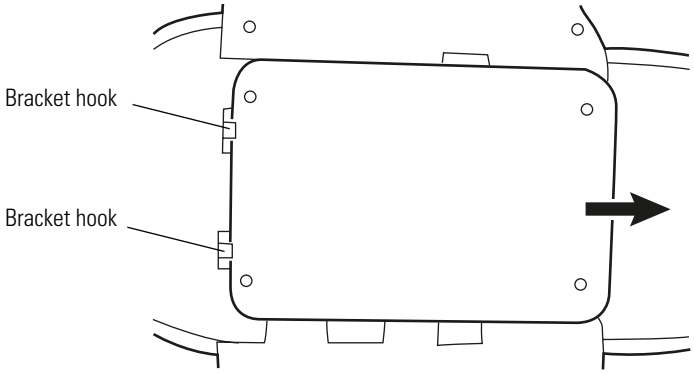
3. Continue with "Removing the Main Board, Subframe and Radio Card (all models)" on page 34.

Disconnecting the SpO_2 Board (Nellcor models)

1. Unplug the flex cables from connectors J1 and J2.



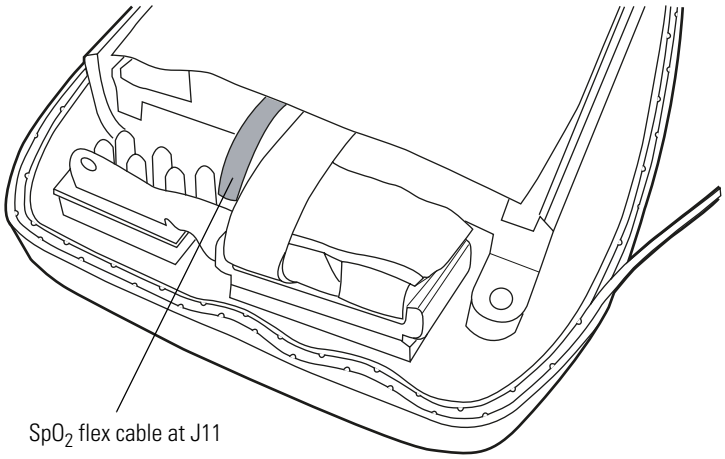
2. Slide the SpO_2 board out from under the two bracket hooks (shown at left in the illustration below).



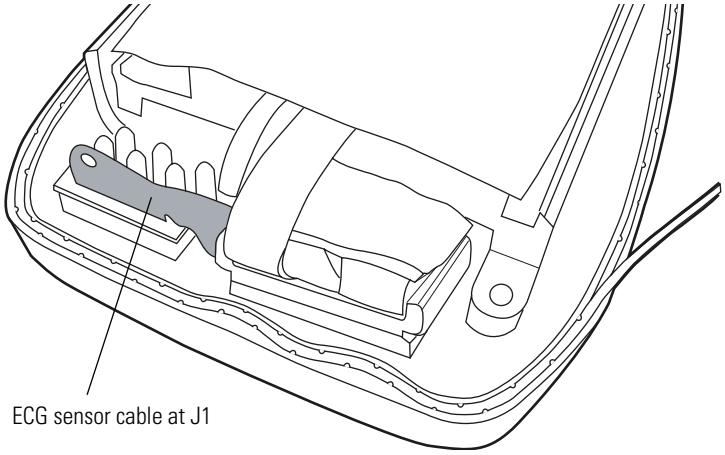
3. Remove the SpO_2 board.

Removing the Main Board, Subframe and Radio Card (all models)

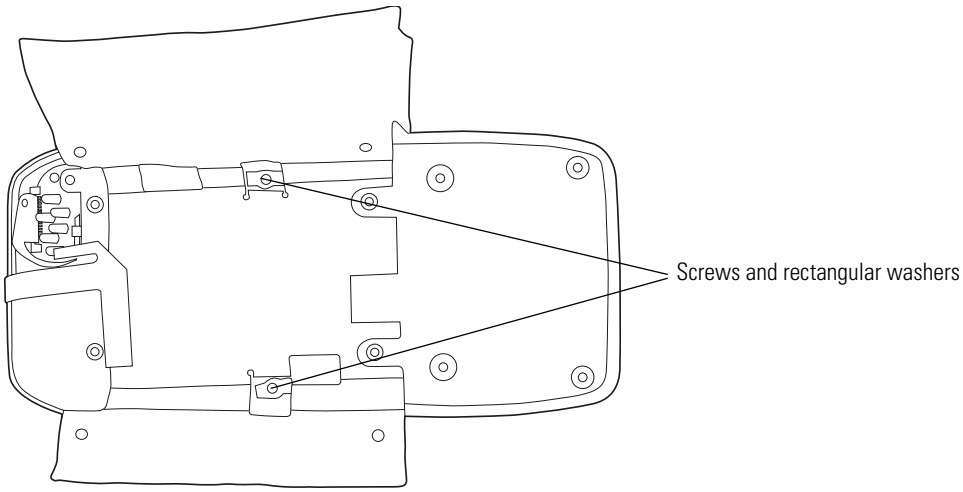
1. Unplug the SpO_2 flex cable at connector J11.



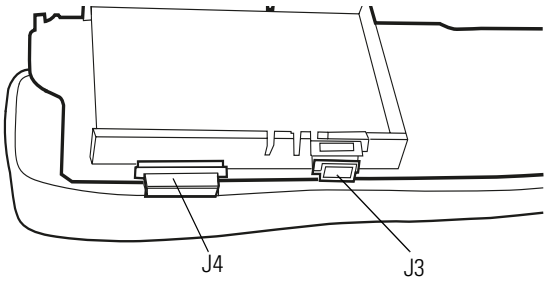
2. Unplug the ECG sensor cable at connector J1.



3. Remove the screws and rectangular washers from the SpO_2 shield.

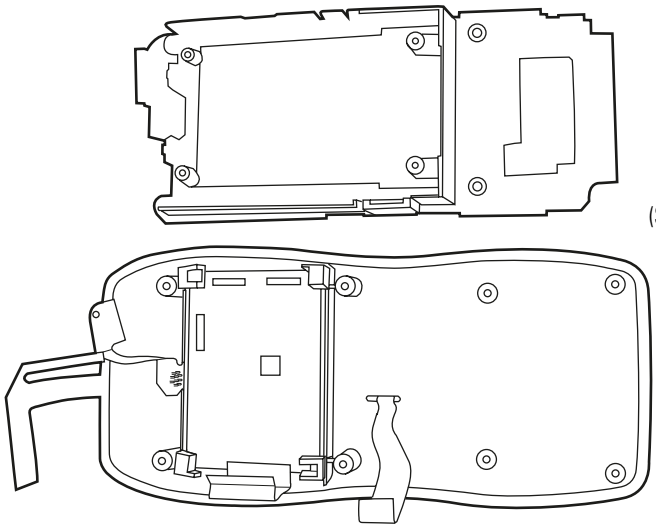


4. Unplug the display cable from connector J4 and keyboard cable from connector J3.



(SpO_2 shield not shown here for clarity.)

5. Remove main board, subframe, and radio card (as one assembly) from the front case.



(SpO_2 shield not shown here for clarity.)

Caution Do not separate the main board, the subframe, and the radio card. They are not serviceable. Separation will damage the single-use antenna connector, which can be replaced only at the factory.

Removing the Display from the Front Case

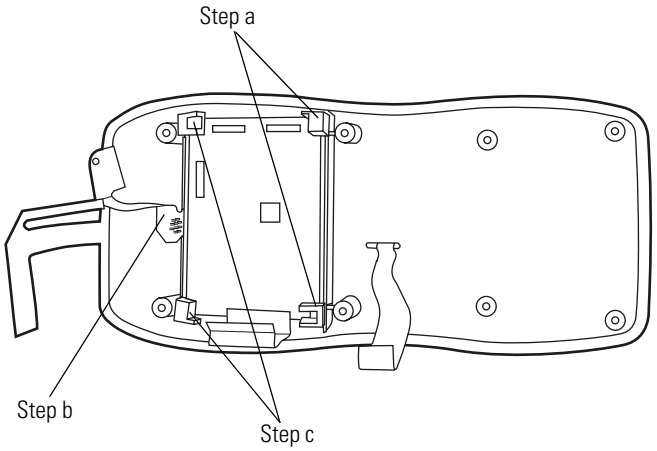
1. Remove the display from the front case using the procedure below.

Caution Failure to follow the sequence below may result in damage to the display—the soldered connections next to the display may scratch the delicate flex cable circuitry.

a. Slightly raise the side of the display farthest from the connectors by using a suitable tool to pry up the rubber cushions.

b. Carefully slide the display out from under the soldered connections.

c. Pry up the rubber cushions closest to the connectors and remove the display.



2. If you are installing a new display, remove and save the rubber cushions.
3. Set the display down on a clean surface with the circuit board side facing up.

Caution Do not bend or stress the display flex cable, especially at its connection to the circuit board.

Caution Do not touch the display screen. Fingerprints are difficult to remove without damaging the display.

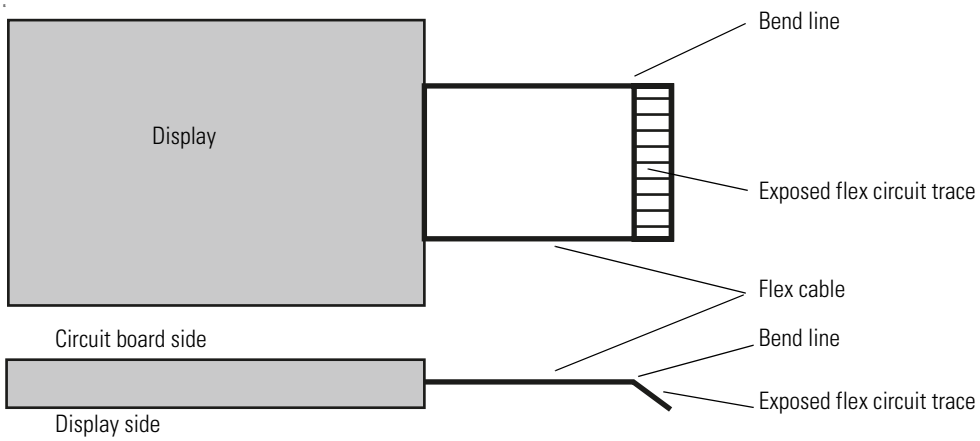
Reassembly - Model 404

Installing the Display

Note The first two steps apply only if you are installing a new display. If you are reusing a display, skip to step 3 on page 38.

Caution The display flex cable is fragile. Damage may result if the flex cable is bent too sharply or if its connection with the circuit board is stressed.

Refer to the illustration.



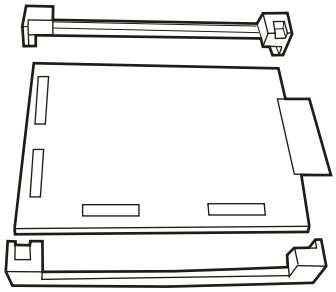
1. Form a 45-degree bend in the end of the display cable.
   a. With needle nose pliers, clamp the flex cable just behind the exposed flex circuit trace. You will form the bend along the edge of the pliers.
   b. Press the end of the flex cable against a hard surface to bend it 45 degrees, toward the display side, at the edge (bend line) of the exposed flex trace.

Caution The direction of the bend is away from the exposed flex circuit trace. Do not bend the cable in the opposite direction.

2. Peel the protective plastic liner from the front of the display.

Note Remove the protective liner before installing the display in the case.

3. Press the rubber cushions onto the display, with the raised cushion corners up as shown.



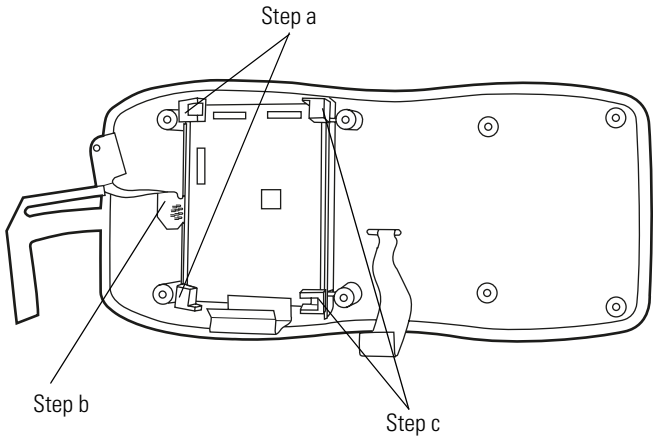
4. Install the display in the front case using the procedure below.

Caution Failure to follow the sequence below may result in damage to the display—the soldered connections next to the display may scratch the delicate flex cable circuitry.

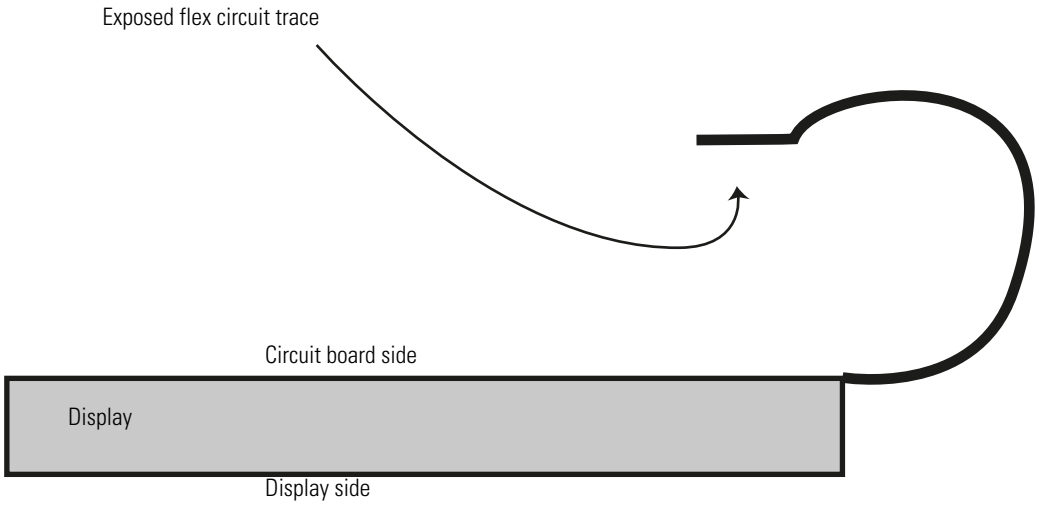
   a. Lower the rubber cushions closest to the connectors into the front case.

   b. Carefully slide the display under the soldered connections.

   c. Press the rubber cushions farthest from the connectors into place.



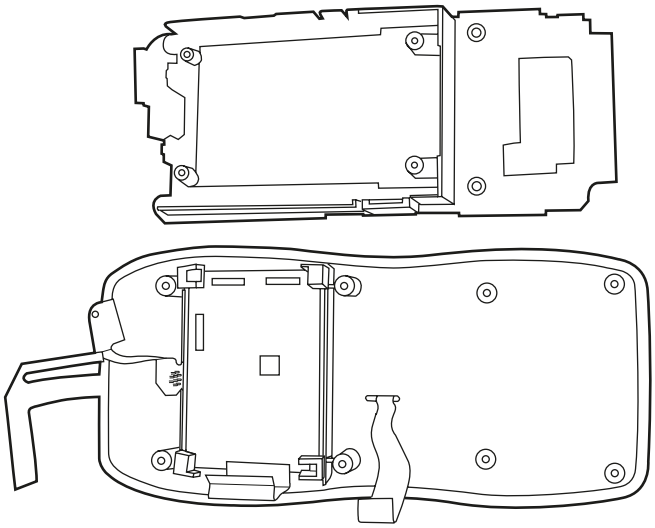
5. Carefully bend the display flex cable so that it curves back toward the circuit board, as shown in the diagram below. The curve will follow the curve of the front case.



Caution The display flex cable is fragile. Damage may result if the flex cable is bent too sharply, or if its connection with the circuit board is stressed.

Installing the Main Board, Subframe and Radio Card

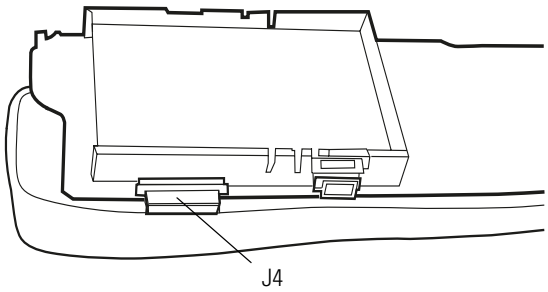
1. Install the main board, subframe and radio card as one assembly onto the front case.



(SpO_2 shield not shown here for clarity.)

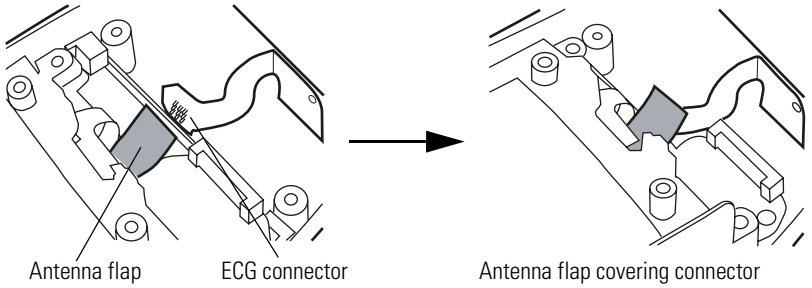
2. Connect the display cable to the J4 connector and lock the latching piece (refer to "Zero Insertion Force (ZIF) Connectors" on page 28 for complete ZIF connector installation instructions.)

Note Tilt the assembly slightly toward the connectors, as shown, to allow insertion of the display flex cable into the J4 connector.

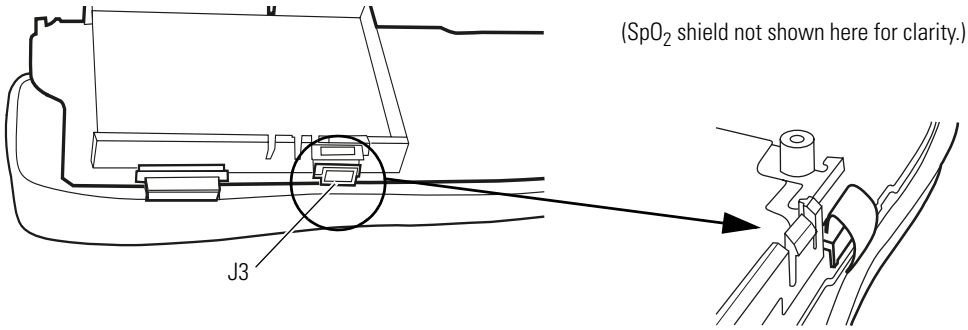


(SpO_2 shield not shown here for clarity.)

3. Insert the display flex cable into the J4 connector and lock the collar.
4. When placing the assembly into the case, verify that the flap on the antenna covers the ECG connector. Failure to cover will cause radio interference problems.

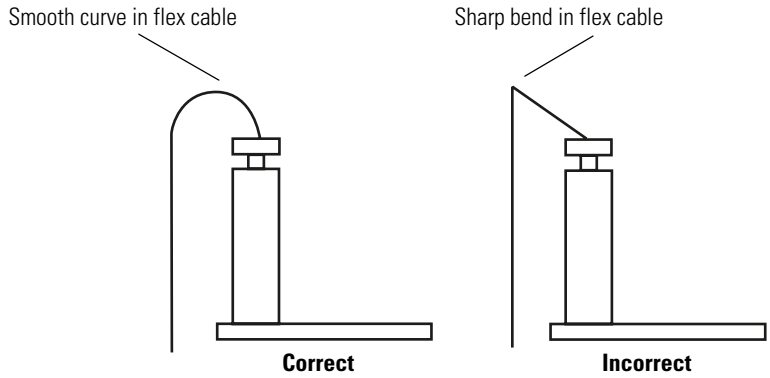


5. Place the main board into the front case.
6. Insert the keyboard cable into the J3 connector and lock the latching piece.

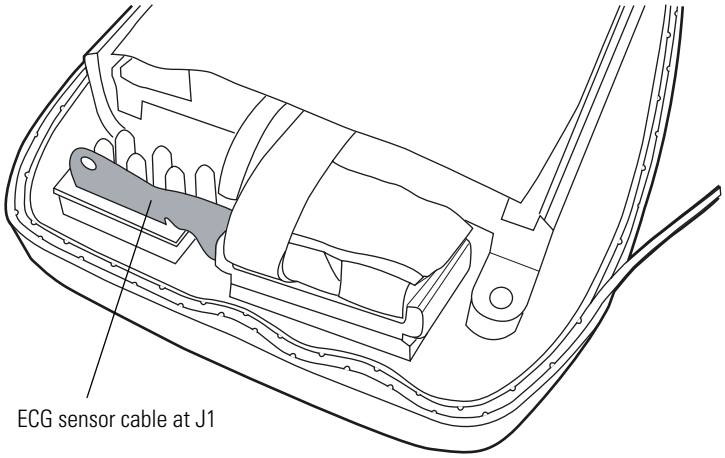


(SpO_2 shield not shown here for clarity.)

Caution When attaching the J3 connector, bend the flex cable toward the connector in a smooth radius curve (as shown below) to avoid cable damage.



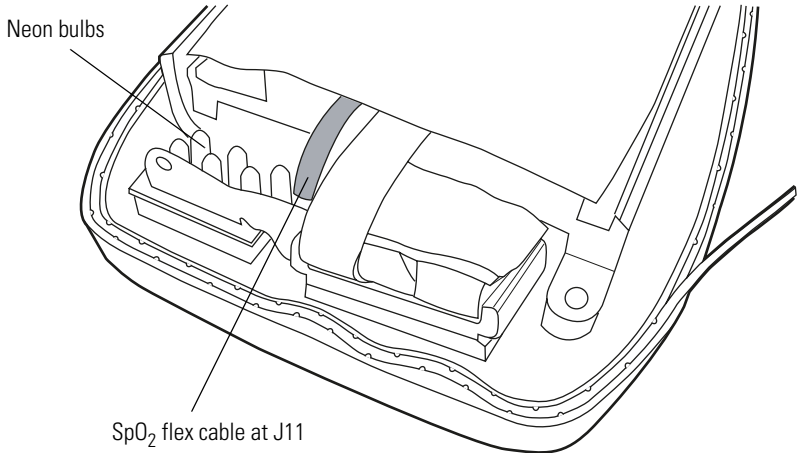
7. Insert the ECG sensor cable into the J1 connector and lock the latching piece.



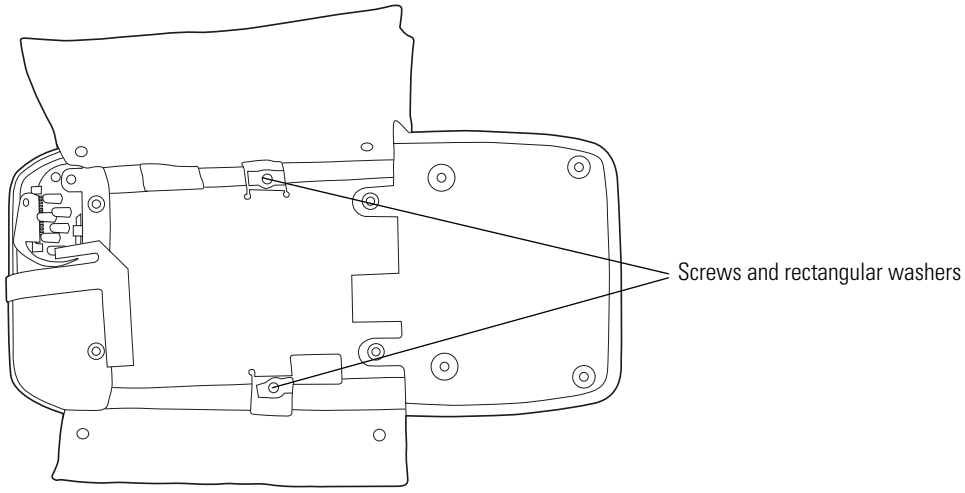
8. Insert the SpO_2 flex cable pin into the J11 connector.

Caution The pin on the SpO_2 flex cable can bend and break easily.

Caution Do not to bend or tilt any of the neon bulbs. They must remain vertical.



9. Install the SpO_2 shield, screws and rectangular washers to secure the main board to the front case. Torque the screws to 3 in. lbs.

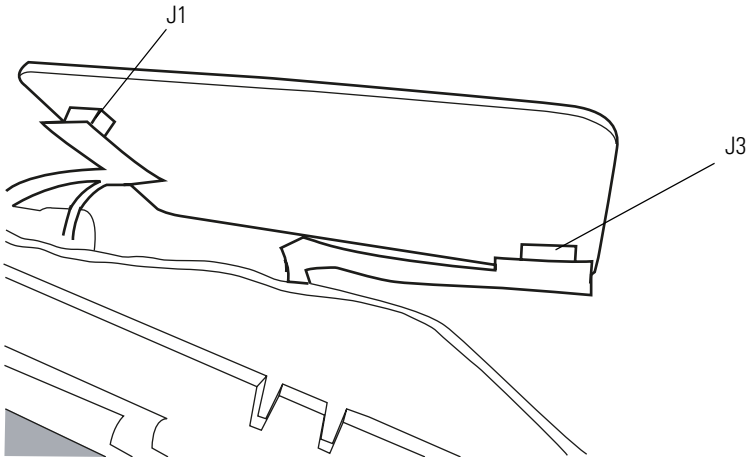


10. For Masimo models, continue with the next section. For Nellcor models, continue with "Installing the SpO2 Board (Nellcor models)" on page 44.

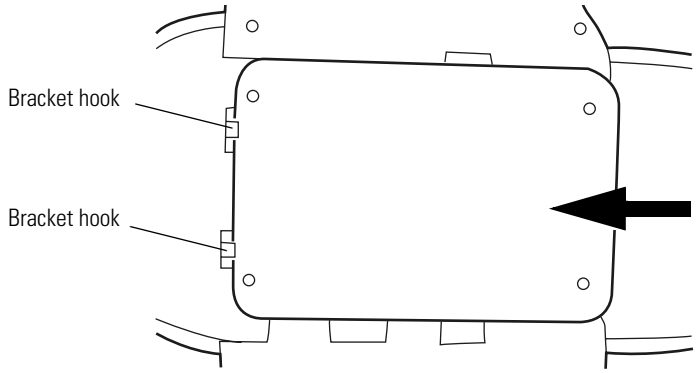
Installing the SpO_2 Board (Masimo models)

This section covers installation of the SpO_2 board on Masimo models. For Nellcor models, go to "Installing the SpO2 Board (Nellcor models)" on page 44.

1. Attach the SpO_2 sensor cables to connectors J1 and J3.

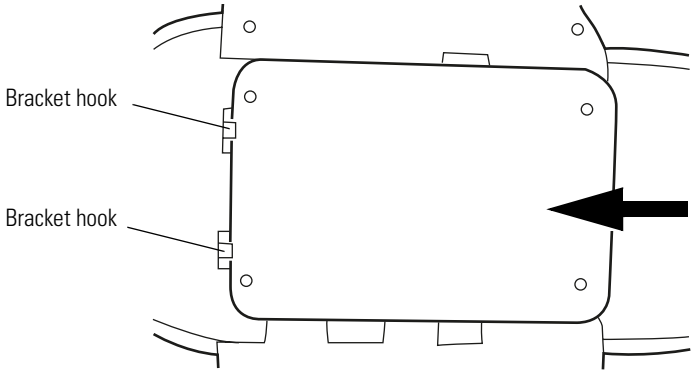


2. Seat the SpO_2 board in place on the subframe, under the bracket hooks as shown.

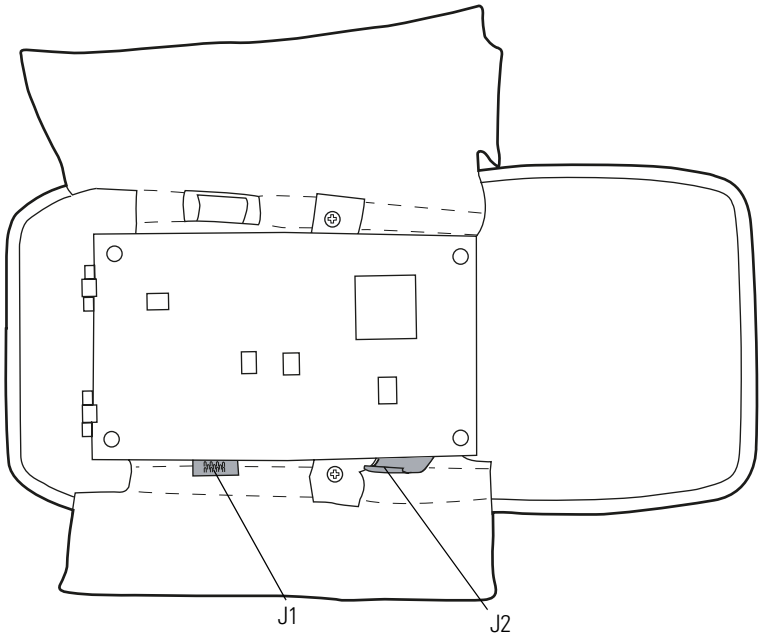


Installing the SpO_2 Board (Nellcor models)

1. Carefully slide the SpO_2 board under the two bracket hooks as shown.



2. Plug the SpO_2 cables into connectors J1 and J2.

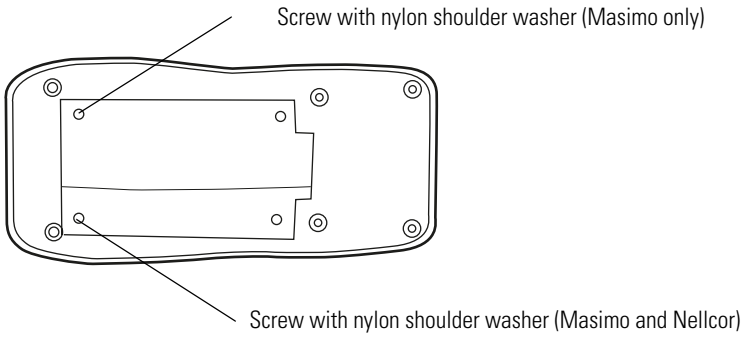


Installing the SpO_2 Shield (all models)

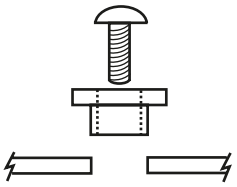
1. Fold the SpO_2 shield closed, with the short side overlapping the long side.
2. Insert the nylon shoulder washer(s) at the location(s) shown above and fully seat in the SpO_2 shield.

Caution Take care to place the nylon washer(s) in the correct location(s) or the system will not operate properly and may cause radio interference problems.

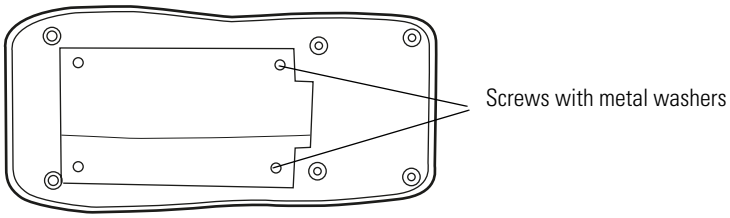
Note The Masimo version has two screws with nylon shoulder washers. The Nellcor version has only one screw with a nylon shoulder washer, as shown below.



3. Add screws after the nylon shoulder washers are seated and torque to 3 in. lbs.



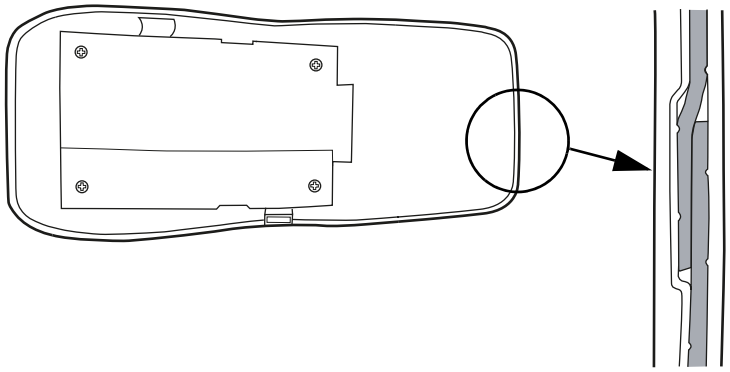
4. Place metal washers and screws in the locations shown below and torque to 3 in. lbs.



Closing the Case

1. Insert the rubber gasket (part of the fastener kit) into the groove in the front case. Begin inserting the gasket in the end locking section, located on the lower edge of the case (as shown below).

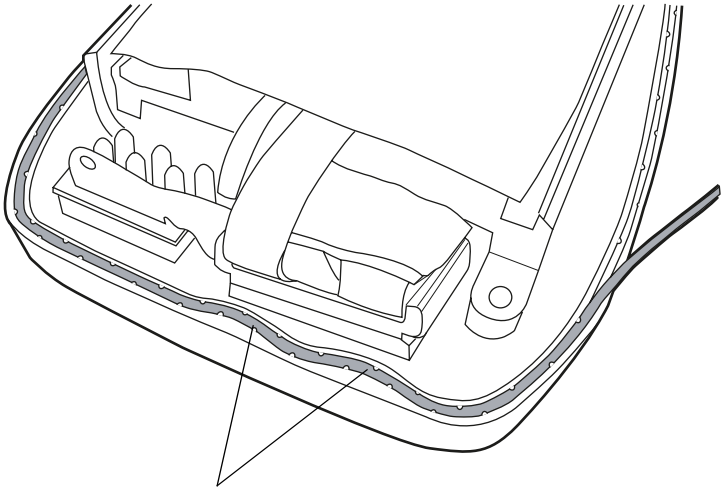
Caution Do not stretch the gasket. Stretching the gasket will make reassembly more difficult, and may result in a poor seal between the front and rear case.



Note Both ends of the gasket should extend as far as possible into the end locking section (refer to the drawing).

Note Do not trim the gasket until it has been fully inserted in the groove, with the overlap as shown above.

Note Take special care when inserting the gasket into the curved section of the groove near the connectors. If the gasket is stretched, it may pull out of the groove at this point.

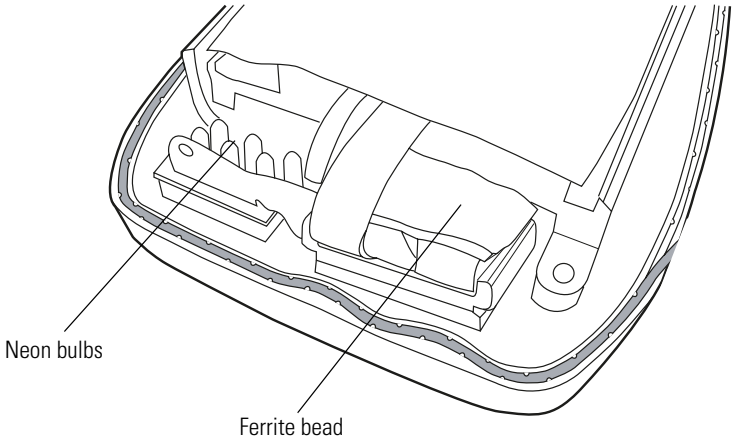


Curved section of gasket groove

2. After fully inserting the gasket into the groove, trim it to the specified length, as shown in the illustration of the end locking section on page 46.
3. Attach the battery and verify that:

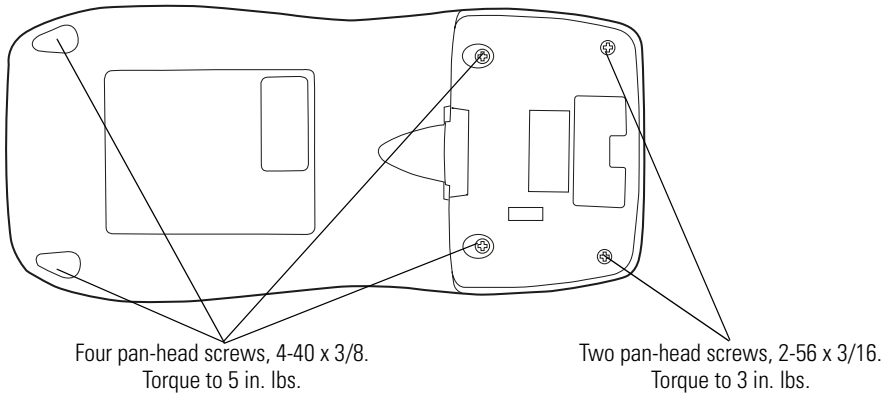
- the LEDs light red, yellow and green,
- no error messages are received,
- the keyboard works.

4. Remove the battery.
5. Adjust the ferrite bead to lay flat and square so that it does not interfere with the placement of the back case.



6. Verify that the neon bulbs are vertical, so that they are not crushed between the front and rear cases during reassembly.
7. Screw the rear case to the front case, making sure the rubber gasket stays in its groove. Torque the screws as shown in the illustration below.

Note Use all new screws, label covers and rubber feet (supplied in the service fastener kit) when reassembling the case.

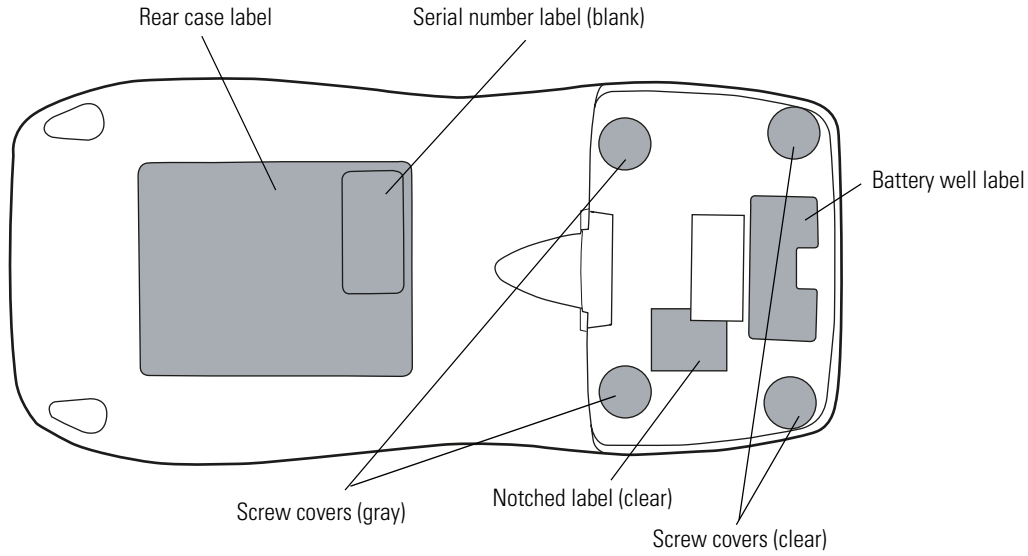


8. Push the rubber feet into the rear case. For ease of installation, apply a small amount of alcohol to the rubber feet.

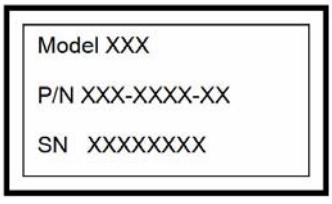
Attaching Labels

Most of the labels shown below are part of the service fastener kit. The clear serial number cover (not shown below) and the blank serial number label are included in the rear case service kit.

The rear case and battery well labels must be ordered separately.



1. Apply the gray screw covers over the upper screw holes in the battery area.
2. Apply the clear screw covers over the lower screws in the battery well.
3. Apply the notched label over the small recessed connector next to the battery connector.
4. Apply the rear case and battery well labels.
5. Apply the blank serial number label to the rear case label at the location shown above.
6. Mark the blank serial number label with the model number, part number and serial number as shown below. Use an ultrafine point permanent marker. Write small to fit in all the required information.



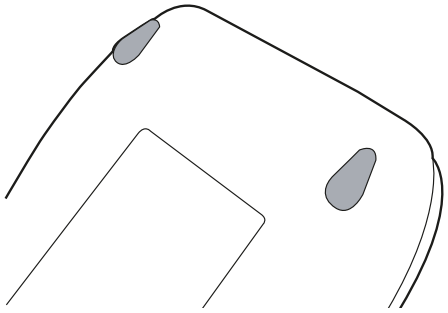
7. Apply the clear cover over the marked serial number label.
8. Attach the battery and verify that:
   - the LED lights red, yellow and green,
   - no error messages are received,
   - the keyboard works.

Disassembly - Model 402

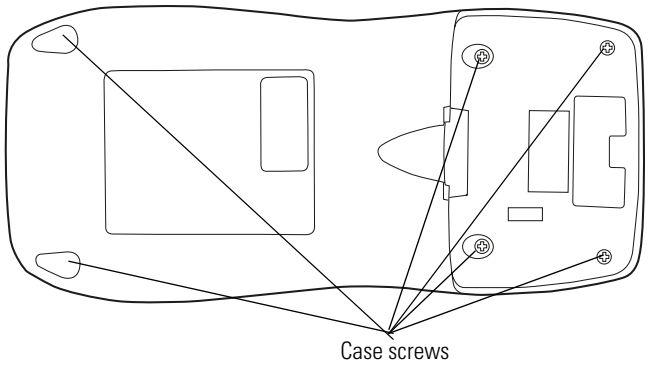
This procedure covers the Model 402 monitor with ECG only.

Opening the Case

1. Remove the battery pack.
2. Remove the rubber feet from the rear panel.



3. Remove the six case screws.

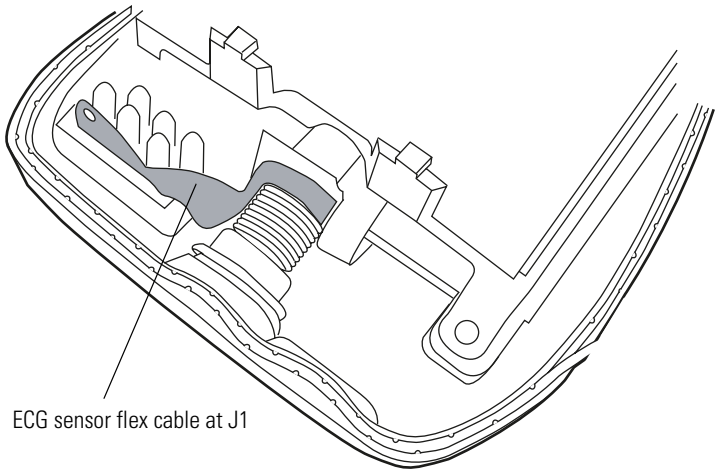


4. Separate the case.

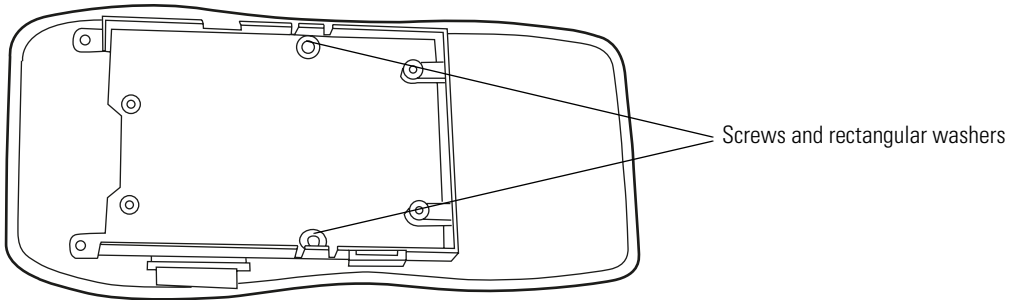
Note If you are replacing only the rear case, proceed to "Closing the Case" on page 57.

Removing the Main Board, Subframe and Radio Card

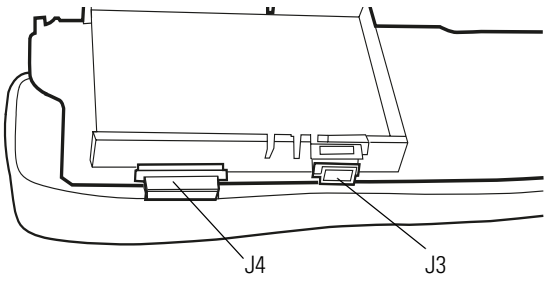
1. Unplug the ECG sensor cable at connector J1.



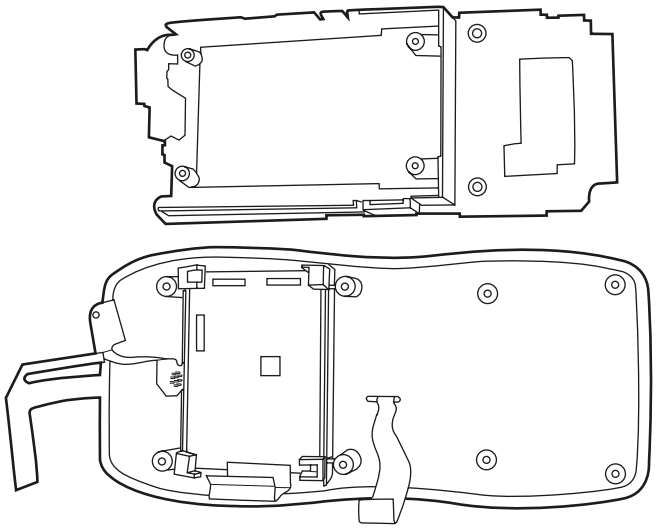
2. Remove the screws and rectangular washers from the subframe.



3. Unplug the display cable from connector J4 and keyboard cable from connector J3.



4. Remove main board, subframe, and radio card (as one assembly) from the front case.



Caution Do not separate the main board, the subframe, and the radio card. They are not serviceable. Separation will damage the single-use antenna connector, which can be replaced only at the factory.

Removing the Display from the Front Case

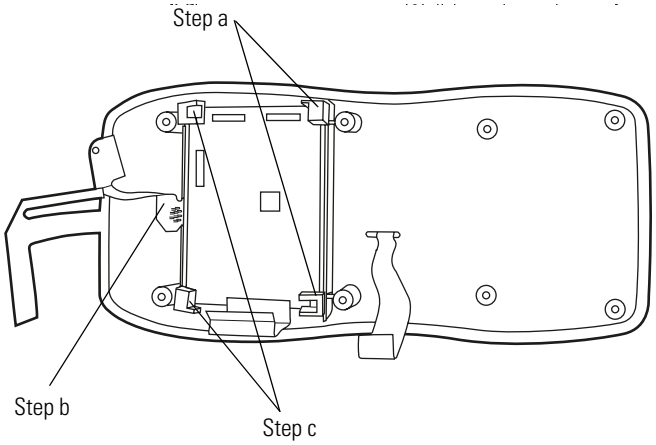
1. Remove the display from the front case using the procedure below.

Caution Failure to follow the sequence below may result in damage to the display—the soldered connections next to the display may scratch the delicate flex cable circuitry.

   a. Slightly raise the side of the display farthest from the connectors by using a suitable tool to pry up the rubber cushions.

   b. Carefully slide the display out from under the soldered connections.

   c. Pry up the rubber cushions closest to the connectors and remove the display.



2. If you are installing a new display, remove and save the rubber cushions.

3. Set the display down on a clean surface with the circuit board side facing up.

Caution Do not bend or stress the display flex cable, especially at its connection to the circuit board.

Caution Do not touch the display screen. Fingerprints are difficult to remove without damaging the display.

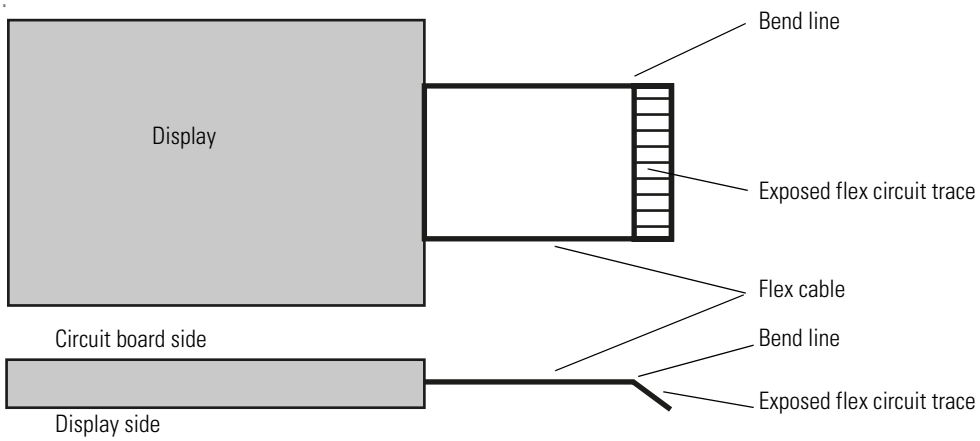
Reassembly - Model 402

Installing the Display

Note The first two steps of this section apply only if you are installing a new display. If you are reusing a display, skip to step 3 on page 54.

Caution The display flex cable is fragile. Damage may result if the flex cable is bent too sharply or if its connection with the circuit board is stressed.

Refer to the illustration.



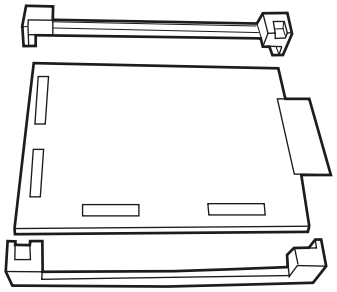
1. Form a 45-degree bend in the end of the display cable.
   a. With needle nose pliers, clamp the flex cable just behind the exposed flex circuit trace. You will form the bend along the edge of the pliers.
   b. Press the end of the flex cable against a hard surface to bend it 45 degrees, toward the display side, at the edge (bend line) of the exposed flex trace.

Caution The direction of the bend is towards the exposed flex circuit trace. Do not bend the cable in the opposite direction.

2. Peel the protective plastic liner from the front of the display.

Note Remove the protective liner before installing the display in the case.

3. Press the rubber cushions onto the display, with the raised cushion corners up as shown.



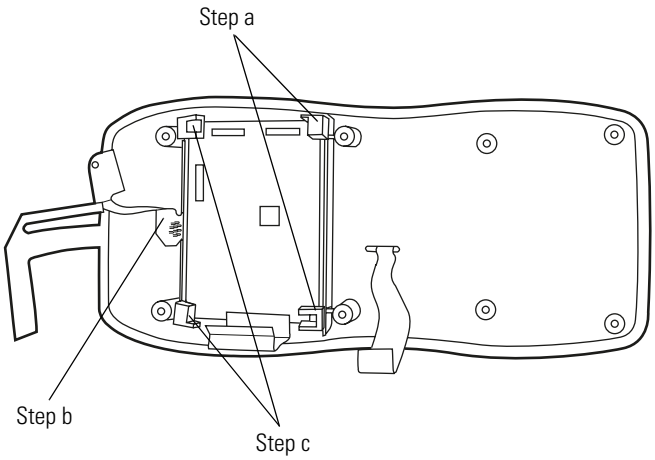
4. Install the display in the front case using the procedure below.

Caution Failure to follow the sequence below may result in damage to the display—the soldered connections next to the display may scratch the delicate flex cable circuitry.

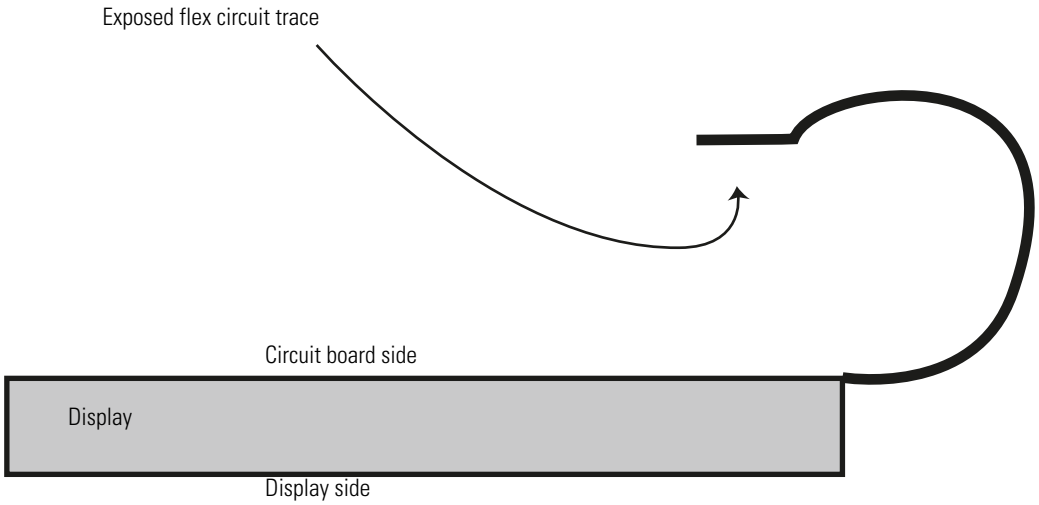
   a. Lower the rubber cushions closest to the connectors into the front case.

   b. Carefully slide the display underneath the soldered connections.

   c. Press the rubber cushions farthest from the connectors into place.



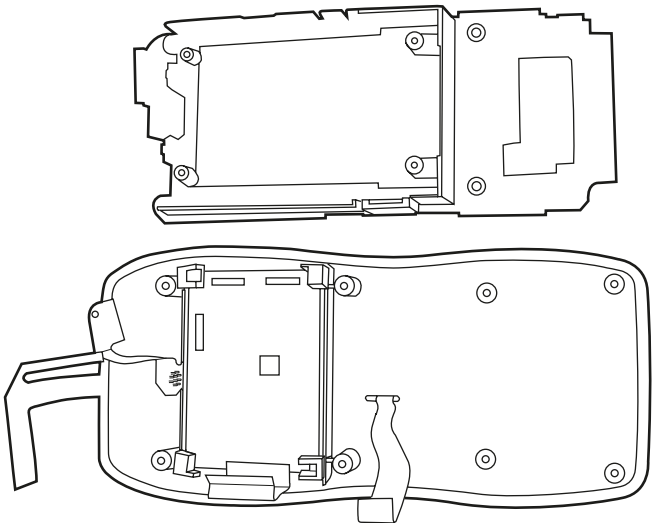
5. Carefully bend the display flex cable so that it curves back toward the circuit board, as shown in the diagram below. The curve will follow the curve of the front case.



Caution The display flex cable is fragile. Damage may result if the flex cable is bent too sharply, or if its connection with the circuit board is stressed.

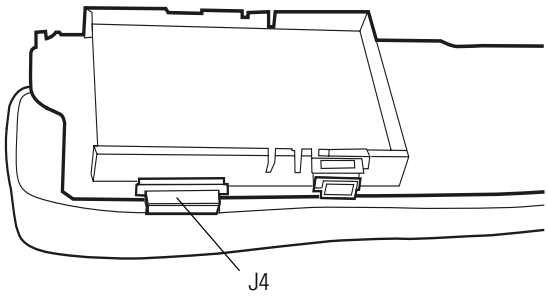
Installing the Main Board, Subframe and Radio Card

1. Install the main board, subframe and radio card as one assembly onto the front case.

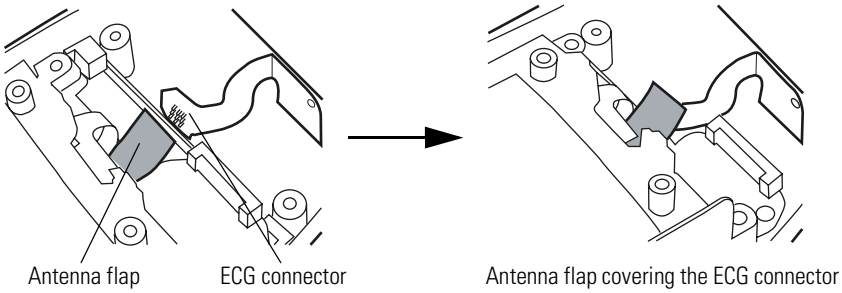


2. Connect the display cable to the J4 connector and lock the latching piece (refer to "Zero Insertion Force (ZIF) Connectors" on page 28 for complete ZIF connector installation instructions.)

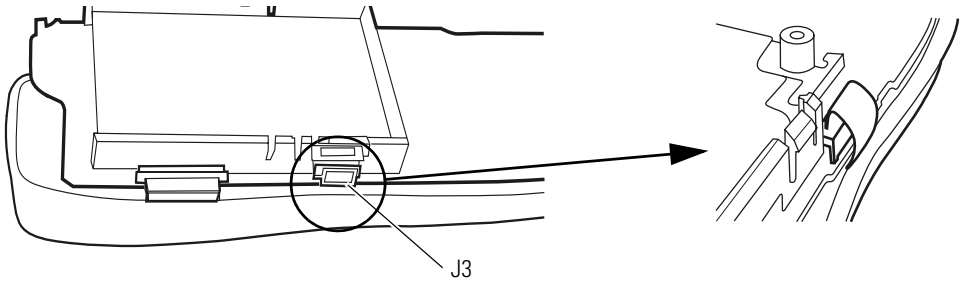
Note Tilt the assembly slightly toward the connectors, as shown, to allow insertion of the display flex cable into the J4 connector.



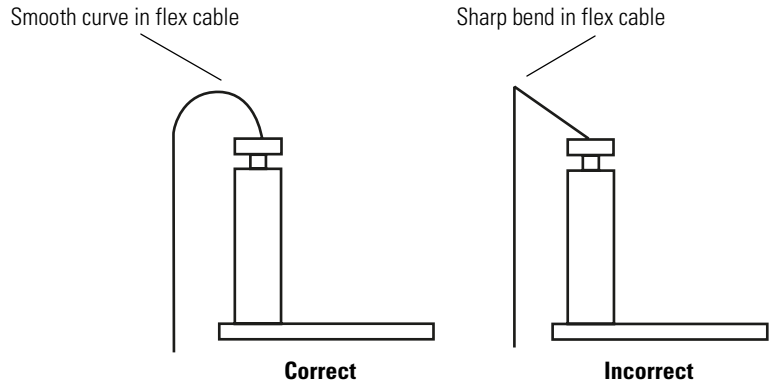
3. Insert the display flex cable into the J4 connector.
4. When placing the assembly into the case, verify that the flap on the antenna covers the ECG connector. Failure to cover will cause radio interference problems.



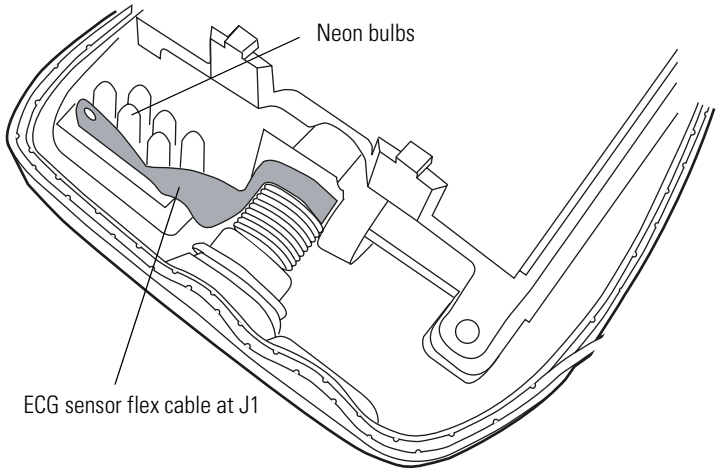
5. Place the main board into the front case.
6. Insert the keyboard cable into the J3 connector and lock the latching piece.



Caution When attaching the J3 connector, bend the flex cable toward the connector in a smooth curve (shown below at left) to avoid cable damage.

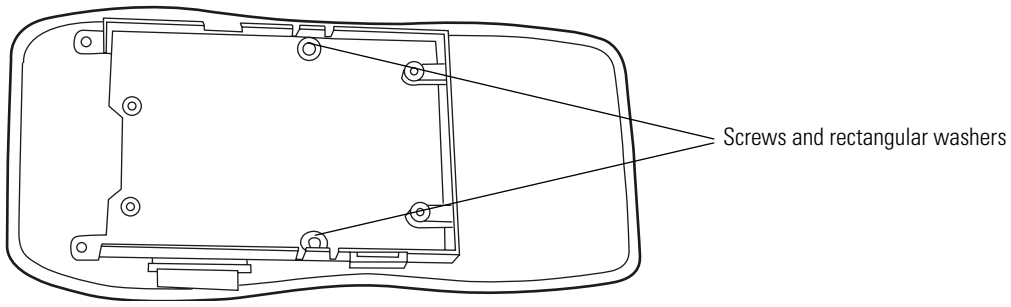


7. Insert the ECG sensor cable into the J1 connector and lock the latching piece.



Caution Do not to bend or tilt any of the neon bulbs. They must remain vertical.

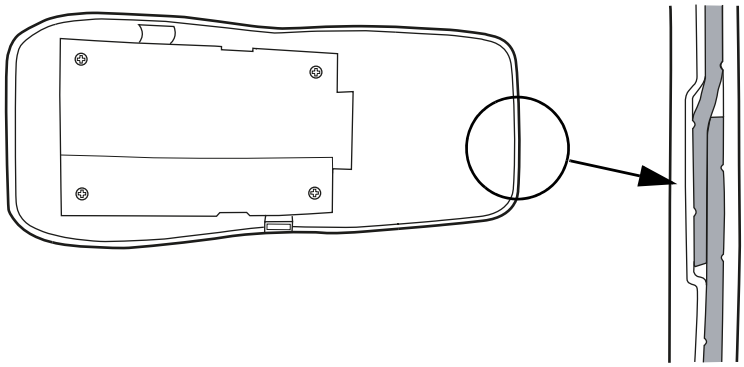
8. Install the screws and rectangular washers to secure the main board to the front case. Torque the screws to 3 in. lbs.



Closing the Case

1. Insert the rubber gasket (part of the fastener kit) into the groove in the front case. Begin inserting the gasket in the end locking section, located on the lower edge of the case (as shown below).

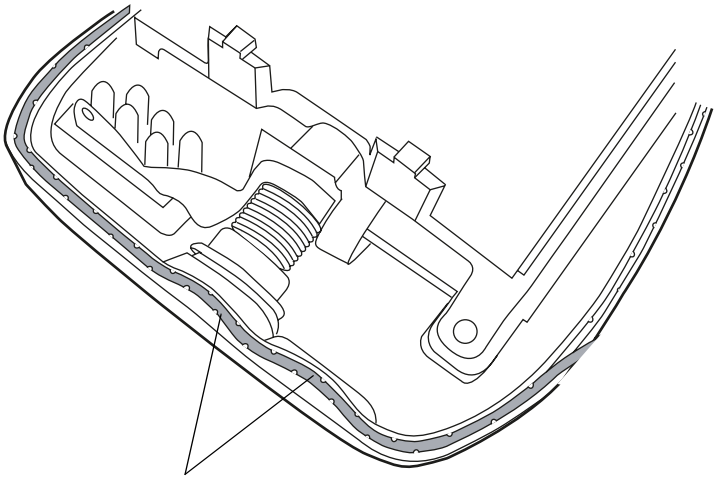
Caution Do not stretch the gasket. Stretching the gasket will make reassembly more difficult, and may result in a poor seal between the front and rear case.



Note Both ends of the gasket should extend as far as possible into the end locking section (refer to the drawing).

Note Do not trim the gasket until it has been fully inserted in the groove, with the overlap as shown above.

Note Take special care when inserting the gasket into the curved section of the groove near the connectors. If the gasket is stretched, it may pull out of the groove at this point. (See the illustration below.)

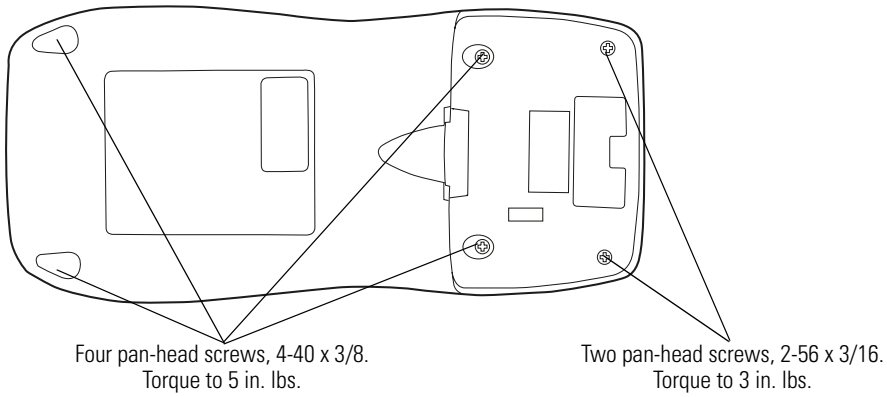


Curved section of gasket groove

2. After fully inserting the gasket into the groove, trim it to the specified length, as shown in the illustration of the end locking section on page 57.
3. Attach the battery and verify that:
   - the LEDs light red, yellow and green
   - no error messages are received
   - the keyboard works

4. Remove the battery.
5. Verify that the neon bulbs are vertical, so that they are not crushed between the front and rear cases during reassembly.
6. Screw the rear case to the front case, making sure the rubber gasket stays in its groove. Torque the screws as shown in the illustration below.

Note Use all new screws, label covers and rubber feet (supplied in the service fastener kit) when reassembling the case.

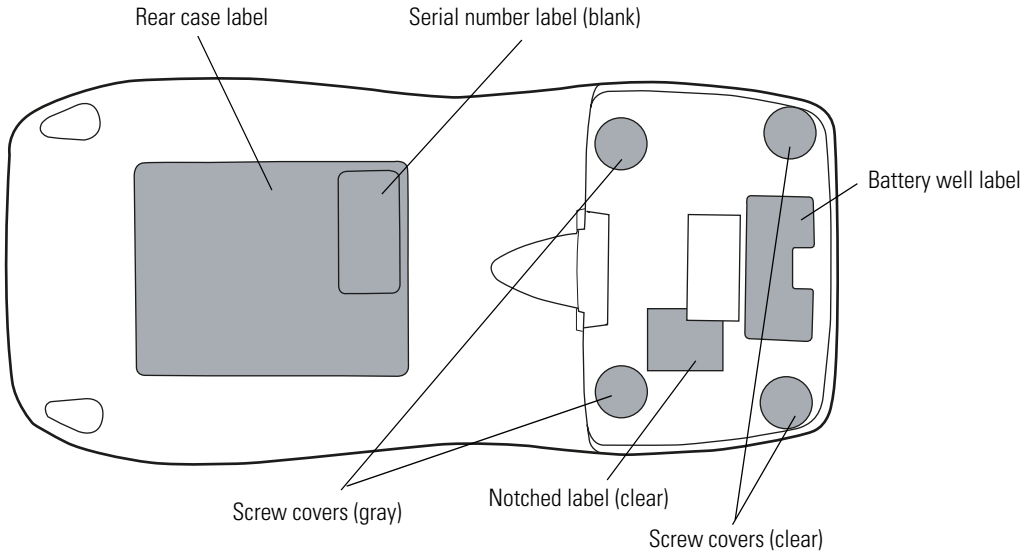


7. Push the rubber feet into the rear case. For ease of installation, apply a small amount of alcohol to the rubber feet.

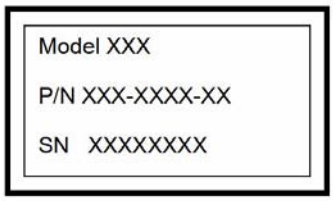
Attaching Labels

Most of the labels shown below are part of the service fastener kit. The clear serial number cover (not shown below) and the blank serial number label are included in the rear case service kit.

The rear case and battery well labels must be ordered separately.



1. Apply the gray screw covers over the upper screw holes in the battery area.
2. Apply the clear screw covers over the lower screws in the battery well.
3. Apply the notched label over the small recessed connector next to the battery connector.
4. Apply the rear case and battery well labels.
5. Apply the blank serial number label to the rear case label at the location shown above.
6. Mark the blank serial number label with the model number, part number and serial number as shown below. Use an ultrafine point permanent marker. Write small to fit in all the required information.



7. Apply the clear cover over the marked serial number label.
8. Attach the battery and verify that:
   - the LED lights red, yellow and green,
   - no error messages are received,
   - the keyboard works.

6 Technical Overview

Feature Summary

The monitor is a patient-worn vital signs monitor for use by adult or pediatric ambulatory patients.

- One or two ECG channels displayed
- Up to 2 ECG leads displayed at the monitor: I, II, III, V, aV_R, aV_L, or aV_F with 5-lead cable
- Up to 7 ECG leads displayed at Acuity: I, II, III, V, aV_R, aV_L, or aV_F with 5-lead cable
- Pulse oximetry (SpO_2) monitoring with advanced technology for accuracy under motion and low perfusion conditions (Micropaq 404 only)
- Two-way wireless communication within Welch Allyn's FlexNet network
- LCD for display of ECG waveforms, SpO_2 and heart rate/pulse rate data, and messages from Acuity
- Standalone operation with patient alarms when out of range of the network
- Patient alarm limits that can be set at the monitor or Acuity Central Station
- Configurable formats for single- or dual-waveform ECG display
- Internal antenna
- Nurse call key
- Lightweight (slightly more than 1 pound with battery)
- Rugged and tolerant of brief water exposure
- Rechargeable battery
- Sleep mode to extend battery life

Micropaq 402

ECG monitoring

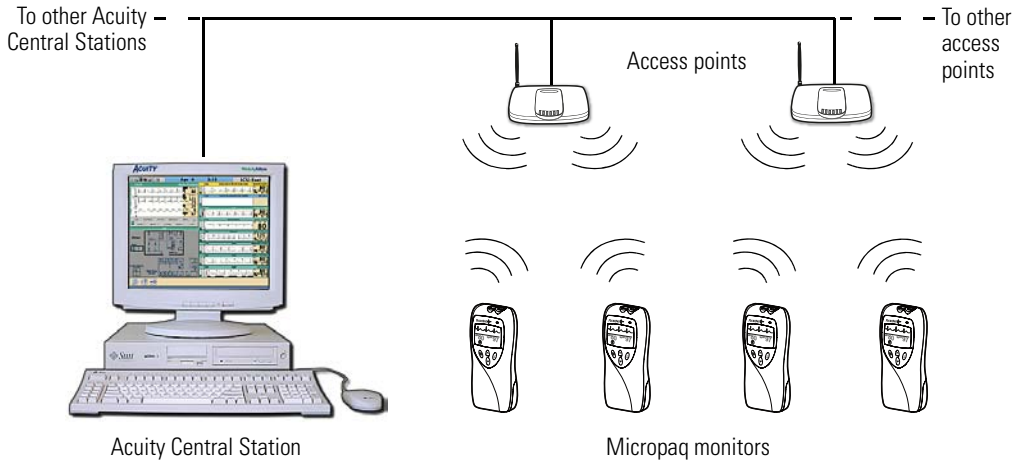
Micropaq 404

ECG monitoring and either of two pulse oximetry (SpO_2) monitoring options:

- SpO_2 with Masimo SET technology
- SpO_2 with Nellcor OxiMax technology

Understanding Micropaq and the FlexNet Network

The monitor is intended to operate with an Acuity Central Station as part of Welch Allyn's FlexNet network. FlexNet allows multiple devices to communicate through hardwired Ethernet networks and Wireless Local Area Networks (WLANs). The Acuity Central Station provides the primary display and entry of patient data for a patient connected to the monitor.



FlexNet Network

Each patient-worn monitor supports two-way communication with an Acuity Central Station through an access point in the FlexNet network. The access point is a digital radio transceiver that connects to the FlexNet network. During monitoring, the monitor sends the patient data to Acuity. Acuity and the monitor continuously analyze the data. Acuity provides appropriate alarm or alert messages at the Central Station and other network devices such as a hallway message panel and the monitor itself. Acuity also stores the patient data for viewing or report printing.

If the monitor is moved out of range or loses communication with the FlexNet network and Acuity, it continues to monitor the patient and display patient data. While not communicating with Acuity, the monitor continues to generate local patient alarms or alert messages. Patient data is not stored and Acuity does not perform waveform analysis or generate arrhythmia messages while the monitor is not communicating with Acuity.

When the monitor is returned to within range of the FlexNet network, it automatically reconnects to Acuity.

7 Field Replaceable Units

This list includes field-replaceable service parts only. Product accessories are listed separately in Welch Allyn *Products and Accessories* (810-0409-XX), which is available from Welch Allyn Customer Service.

The following table lists parts available for the Micropaq monitor.

Table 1. Service Parts List

Order Number	Item Description	Model
640-0513-04	Label, Rear/Batt Well, Sheet, Masimo, Micropaq	404 with Masimo
640-0540-02	Label, Rear/Batt Well, Sheet, Nellcor, Micropaq	404 with Nellcor
640-0600-XX	Label, Rear/Battery Well, Sheet, ECG Only, Micropaq	402 ECG only
500-0040-00	Display, LCD, 320X200	All
020-0607-XX	Service Kit, Front Case Subassembly, 404, MS5	404 with Masimo
020-0614-XX	Service Kit, Front Case Subassembly, 404, MP-506	404 with Nellcor
020-0606-XX	Service Kit, Front Case Subassembly, 402	402 ECG only
020-0645-XX	Service Kit, Fasteners, Micropaq	All
020-0646-XX	Service Kit, Rear Case, Micropaq	All